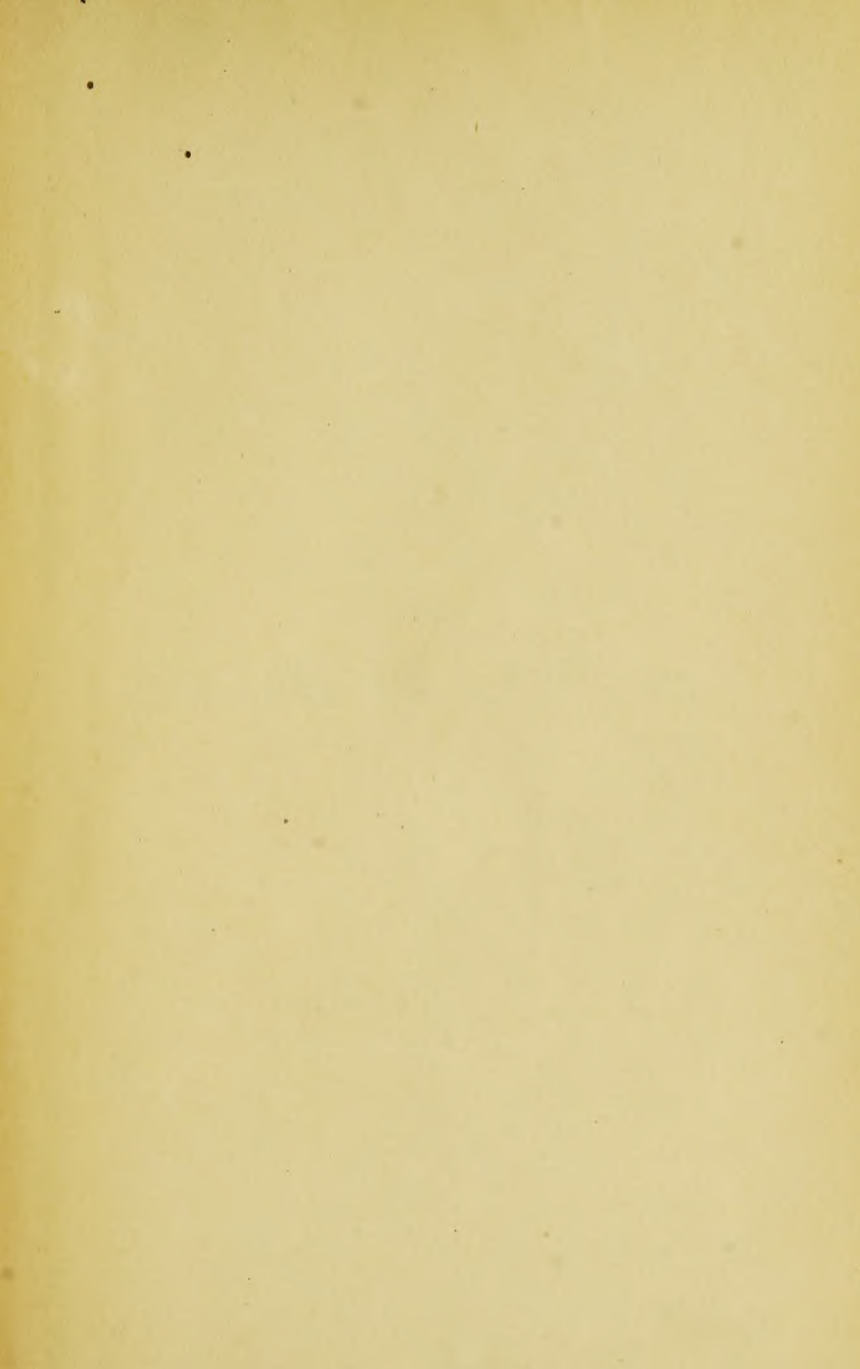


TRANSFERRED TO
YALE MEDICAL LIBRARY



THE
DISEASES OF CHILDREN

BY THE SAME AUTHORS.

NOTES ON PHYSIOLOGY FOR THE USE
OF STUDENTS. By HENRY ASHBY, M.D., F.R.C.P.
Sixth Edition. With 141 Illustrations. Fcp. 8vo. price 5s.

HIP DISEASE IN CHILDHOOD. By G. A.
WRIGHT, B.A., M.B. Oxon., F.R.C.S. Eng. With 48
Original Woodcuts. 8vo. price 10s. 6d.

London : LONGMANS, GREEN, & CO.

THE
DISEASES OF CHILDREN

MEDICAL AND SURGICAL

BY

HENRY ASHBY, M.D.LOND., F.R.C.P.

PHYSICIAN TO THE GENERAL HOSPITAL FOR SICK CHILDREN, MANCHESTER
LECTURER AND EXAMINER IN DISEASES OF CHILDREN IN THE VICTORIA UNIVERSITY
FORMERLY LECTURER ON PHYSIOLOGY IN THE OWENS COLLEGE
AND IN THE LIVERPOOL SCHOOL OF MEDICINE

AND

G. A. WRIGHT, B.A., M.B.OXON., F.R.C.S.ENG.

ASSISTANT SURGEON TO THE MANCHESTER ROYAL INFIRMARY
AND SURGEON TO THE CHILDREN'S HOSPITAL
EXAMINER IN SURGERY IN THE UNIVERSITY OF OXFORD
CORRESPONDING MEMBER OF THE AMERICAN ORTHOPÆDIC ASSOCIATION

THIRD EDITION

EDITED FOR AMERICAN STUDENTS

BY

WILLIAM PERRY NORTHRUP, A.M., M.D.

ADJUNCT PROFESSOR DISEASES OF CHILDREN, BELLEVUE HOSPITAL MEDICAL COLLEGE
ATTENDING PHYSICIAN NEW YORK FOUNDLING, WILLARD PARKER, AND PRESBYTERIAN HOSPITALS
CONSULTING PHYSICIAN NEW YORK INFANT ASYLUM
MEMBER OF THE ASSOCIATION OF AMERICAN PHYSICIANS

NEW YORK
LONGMANS, GREEN, AND CO.

LONDON AND BOMBAY

1897

COPYRIGHT, 1893, BY
LONGMANS, GREEN, AND CO.

COPYRIGHT, 1895, BY
LONGMANS, GREEN, AND CO.

All rights reserved

RJ45
897 A

O - School of Medicine

76a

THE SURVIVAL PART OF THE BOOK I DEDICATE

TO MY FATHER

C. L. FROST

NOTE TO THE SECOND AMERICAN EDITION

IN preparing this edition for the American Reader it has been thought best to leave the body of the book intact. The same disease differs but little in its course in America and in England; it is necessary, therefore, to note only such differences in theory and in treatment as shall seem to bring the book into accord with present American practice. This has been done by means of the Appendix, care being taken to refer supplementary matter to its proper connection in the main work by page references, and by additions to the Index.

The Formula (page 811) have been entirely rewritten to conform to the United States Pharmacopœia.

The supplementary additions to the Surgical portion of the book have been made by Dr. T. Halsted Myers, Attending Orthopædic Surgeon to St. Luke's Hospital, New York, whose contributions are also embodied in the Appendix.

The Editor trusts that these additions may still further increase the usefulness among American readers of this complete and condensed treatise, which has so quickly passed to its third edition.

W. P. N.

NEW YORK, 1896.

PREFACE
TO
THE THIRD EDITION

IN PREPARING the Third Edition the whole of the work has been thoroughly revised, and some of the sections, more especially those on Infant Feeding, Anæmia, and Chronic Heart Disease, have been almost entirely rewritten. Considerable additions have been made to the Surgical part, and mention will be found of the more valuable improvements introduced since the last edition in 1892. The book is enlarged by over fifty pages, the formulary has been much expanded, and fourteen new woodcuts have been added.

We must again express our thanks to our colleague Dr. H. R. HUTTON, and also to our friend Dr. J. S. BURY, for much help and kindly criticism.

HENRY ASHBV.
G. A. WRIGHT.

MANCHESTER: *Sponks, 1895.*

PREFACE
TO
THE FIRST EDITION

THE PRESENT WORK is intended to give to senior students and junior medical practitioners a fairly complete, though necessarily condensed, account of the various morbid conditions peculiar to, or chiefly found during, infancy and childhood. Those diseases which are neither special to children nor modified by their occurrence in early life are either omitted altogether or only briefly considered.

The book is written from a practical point of view, and but little pathological detail will be found in it.

The basis of our work is our experience at the General Hospital for Sick Children, Manchester, an institution at which some 1,200 in-patients and some 10,000 out-patients are annually treated. Our observations have extended over nearly ten years, and during the whole of that time we have been collecting material both at the Children's Hospital and at the Royal Infirmary for this purpose.

The original feature of this book is that it is written conjointly by a physician and a surgeon; it is hoped that it presents, therefore, a fairly complete account of disease in children. Though we are well aware that the book is not an exhaustive treatise, we think it will be found practical, and it is at least based on experience and is not a mere compilation.

The illustrations are almost entirely taken from photographs of cases that have been under our own care; where this is not so, their source is acknowledged.

We have to tender our cordial thanks to our friends and colleagues, both at the Children's Hospital and at the Royal Infirmary, for their help. Our thanks are also due to successive generations of house surgeons who have kept the records of our cases.

To our colleague, Dr. HUTTON, for allowing us without stint the use of his cases, as well as for much help and advice in correcting our proofs, our especial thanks are due; also to Messrs. SOUTHAM and COLTART, our colleagues at the Royal Infirmary and the Children's Hospital, for their care and kindness in proof-reading. To Mr. WILSON we owe our chapter on Anæsthetics, which is made especially valuable by his large experience in the administration of these agents both at the Children's Hospital and at the Royal Infirmary. To Drs. HUMPHREYS and MASSIEH, our former colleagues, we are also indebted for the use of their notes of cases.

We must also acknowledge the help rendered to us by Messrs. PAINÉ and BROWN in connection with the formulae for medicines and external applications given in this work.

We cannot take leave of our work without further acknowledging our indebtedness to the Board of Governors of the Children's Hospital for their generous treatment of us, and especially for enabling us to publish our annual abstracts of cases treated at the Hospital. We also desire to express our appreciation of the value of the work of our sisters and nurses in making observations of cases, and in the preparation of temperature charts.

To Messrs. LONGMAN, our publishers, we are much indebted for their liberality in allowing us to borrow woodcuts from their published works, and for their help in many ways; we desire also to acknowledge the great pains and skill shown by Mr. PEARSON in engraving our photographs.

HENRY ASHBY,
G. A. WRIGHT.

CONTENTS

CHAPTER I

THE PHYSIOLOGY OF INFANCY AND CHILDHOOD

The periods of life, 1 : intra-uterine life, 1 : infancy, 1 : childhood, 2 : youth, 2 : respiration, 3 : changes in the circulation after birth, 4 : amount of blood in body, 4 : pulse, 5 : alimentary canal, 5 : urine, 6 : temperature, 7 : nervous system, 7 : sight, 8 : hearing, 8 : taste, 9 : psychical phenomena, 9 : sleep, 9 : body weight, 9 : length, 10 : dentition, 11 : mortality, 12.

CHAPTER II

THE DISEASES INCIDENT TO BIRTH

Aplasia nasalis, 15 : *aplasia hematuria*, 15 : *cephalhematoma*, 20 : *hernia* of the sternum-muscle, 23 : *oblique paralysis*, 24 : *irritus neonatorum*, 25 : *hemorrhagic diathesis*, 27 : *acute lary degeneration of the newly born*, 28 : *Winkler's disease*, 28 : *gastro-intestinal hemorrhage*, 28 : *hemorrhage from the genital organs*, 29 : *diseases of the nasal*, 29 : *umbilical polypus*, 29 : *emphysema*, 31 : *gangrene of the navel*, 31 : *umbilical arteritis*, 32 : *umbilical polycystis*, 32 : *umbilical hemorrhage*, 33 : *irritus nascentium*, 34 : *sclerema neonatorum*, 35 : *infans neonatorum*, 36 : *gonorrheal ophthalmia*, 36.

CHAPTER III

THE HYGIENE AND DIET OF INFANTS AND CHILDREN

New-born infants, 37 : *clothing*, 38 : *infant feeding*, 38 : *wet nurses*, 40 : *weaning*, 41 : *artificial feeding*, 42 : *cow's milk*, 43 : *woman's milk*, 44 : *cream mixture*, 45 : *diluted milk*, 47 : *boiled water*, &c., 48 : *whisky*, 48 : *peptonized milk*, 48 : *sterilization*, 49 : *condensed milk*, 50 : *dried milk foods*, 51 : *amount of food*, 52 : *feeding-bottles*, 52 : *diet from 6 to 12 months*, 53 : *diet from 12 months to 18 months of age*, 54.

CHAPTER IV

DISEASES OF THE DIGESTIVE SYSTEM

Examination of the mouth, 55; dentition, 55; catarrh of mouth, 56; stomatitis erythematosa, 56; aphthæ, 56; parvula stomatitis, 60; diphtheritic stomatitis, 62; alveolar abscess, 63; cancrum oris, 64; acute tonsillitis, 65; chronic tonsillitis, 66; tonsillar calculus, 71; nasal adenoids, 72; pharyngeal pouch, 73; iron pharyngeal abscess, 73; stricture of œsophagus, 74; swallowing foreign bodies, 75; tracheitis, 76.

CHAPTER V

DISEASES OF THE DIGESTIVE SYSTEM (continued)

Examination of the stomach, 77; dyspeptic diseases, 78; hæmorrhæ and vomit, 79; vomiting, 79; hæmorrhæ, 81; hæmorrhæ, 81; acute gastric catarrh, 85; acute gastro-intestinal catarrh—symptomatic hæmorrhæ, 86; acute gastric catarrh, 87; acute hæmorrhæ, 86.

CHAPTER VI

DISEASES OF THE DIGESTIVE SYSTEM (continued)

Chronic gastro-intestinal catarrh—gastro-intestinal atrophy, 98; chronic hæmorrhæ, 98; chronic vomiting, 100; flat for indigestion, 106; dilatation of stomach, 107; inflammation of stomach, 108; carcinoma of stomach, 108; slow H stomach, 108; thread worms, 109; round worms, 110; tape worms, 110; ascites, 111.

CHAPTER VII

DISEASES OF THE DIGESTIVE SYSTEM (continued)

Acute peritonitis, 113; peritonitis, 117; perforated abscesses—intestinal fistula, 118; chronic peritonitis, 121; liver abscess, 125; intussusception, 125; chronic obstruction of the bowels, 134.

CHAPTER VIII

DISEASES OF THE DIGESTIVE SYSTEM (continued)

Tubercular affection of the bowels—mesenteric disease, 136; congenital obstruction of the bowels, 140; imperforate anus, 142; deformities of the rectum, 145; anal fistula, 147; inguinal hernia, 147; prolapsus recti, 152; hæmorrhoids, 154; piles, 154; polypus of the rectum, 155.

CHAPTER IX

DISEASES OF THE DIGESTIVE SYSTEM (*continued*)

Hypertrophy, 157; cleft palate, 153; microstomia, 156; microstomia, 166; anorexia, 157; tongue, 157; megacolon, 167; cecum, 168; papilloma and carcinoma of the tongue, 168; hypertrophy and atrophy of the liver, 169; lambshead foetus, 169.

CHAPTER X

DISEASES OF THE LIVER

Congenital atrophy of the bile ducts, 173; congenital jaundice, 174; acute yellow atrophy of the liver, 174; alcoholic cirrhosis of the liver, 177; syphilitic cirrhosis, 177; fatty liver, 178; tuberculosis of the liver, 179; biliary abscess, 180; hydatids, 180; tumours of the liver, 180.

CHAPTER XI

DISEASES OF THE RESPIRATORY APPARATUS

The throat in infancy and childhood, 182; infantile respiratory system, 183; laryngeal stridor—chilblain—system of the glottis, 184; spasmodic laryngitis, 185; congenital laryngitis, 189; membranous laryngitis, 190; subglottic, 196; irritation of the larynx, 206; chronic laryngitis, 208; papilloma of the larynx, 208.

CHAPTER XII

DISEASES OF THE RESPIRATORY APPARATUS (*continued*)

Tracheitis and emphysema, 210; collapse of the lung, 212; bronchiectasis and emphysema, 213; chronic bronchitis and bronchiectasis, 213; bacterial pneumonia, 214; secondary pneumonia, 216; chronic lobar pneumonia, 217; different types of pneumonia, 219; croupous pneumonia, 225; gangrene of lung, 223; abscess of the lung, 224; pleurisy and empyema, 224; asthma, 225; diseases of the bronchial glands, 246; mediastinal disease, 245; lymphadenoma, 248; chronic tuberculosis of the lungs, 248; forest phthisis, 251.

CHAPTER XIII

THE SPECIFIC FEVERS

Erysipelatous, 254; gland fever, 255; scarlet fever, 257; surgical scarlet fever, 258; mild scarlet fever, 261; malignant scarlet fever, 261; complications, 263; nephritis, 262; remission, 272; mild form, 276; severe form, 276; Boeck's or Relaps, 279; diphtheria, 283; pleuropneumonia, 286; malignant, 288;

measle (diphtheria, 288; laryngitis, 289; wound diphtheria, 292; complications, 296; pseudo-diphtheria, 294; erythematous inflammation, 295; erythema, 298; complications, 302; typhoid, 307; varicella, 310; varicella gangrenosa, 312; variola, 313; complications, 315; varioloid, 316; whooping cough, 317; erythema, 319; measles—parvitis, 322; scarlatina fever, 323).

CHAPTER XIV

DISEASES OF THE CIRCULATORY SYSTEM

Diseases of the heart, 324; congenital heart disease, 326; patent foramen ovale, 327; patent septum ventriculorum, 329; stenosis of the pulmonary and tricuspid valves, 330; stenosis of the aorta or mitral valves, 330; transposition of the aorta and pulmonary artery, 332; pericarditis, 333; endocarditis, 336; chronic heart disease, 339; acute myocarditis, 343; mediastino-pericarditis, 345; hypertrophic disease, 347.

CHAPTER XV

DISEASES OF THE CIRCULATORY SYSTEM (continued)

Stroke, 349; infarctus cerebri, 349; pulmonary infarct, 349; ectromyositis, 350; arteriosclerosis, 350; aortic aneurysm, 356; aneurysm, 350; arteriovenous fistula, 350; lymphatic aneurysm, 355; aneurysm, 358.

CHAPTER XVI

DISEASES OF THE BLOOD AND BLOOD-MAKING ORGANS

Anemia, 359; anemia with icterus, 360; anemic anemia, 360; aplastic anemia, 361; scurvy, 362; enlarged spleen, 363; anemia splenica, 364; Hodgkin's disease, 366; leucopenia, 367; purpura simplex, 369; peliosis rheumatica, 371; diseases of the two parathyroid glands, 371.

CHAPTER XVII

TUBERCULOSIS, DIABETES, RHEUMATISM

Acute military tuberculosis, 373; typhoid form, 373; broncho-pneumonic form, 375; subacute general tuberculosis, 375; miliary and tuberculosa, 377; tubercular adenitis, 379; chronic atrophy, 380; deep cervical adenitis—ergasia Lischkei, 386; general surgical tuberculosis, 387; diabetes mellitus, 388; polyuria—diabetes insipidus, 389; rheumatism, 390.

CHAPTER XVIII

RICKETS

Rickets, 393; scurvy rickets, 400; skeletal deformities, 407; late rickets, 412; osteotomy, 410; lateral curvature of the spine, 428; antero-posterior curvature, 426.

CHAPTER XIX

SYPHILIS

Syphilis, 427; *acquired syphilis*, 427; *hereditary syphilis*, 428.

CHAPTER XX

DISEASES OF THE NERVOUS SYSTEM

Introduction, 438; *clinical examination*, 439; *cerebral congestion*, 439; *tubercular meningitis*, 440; *simple meningitis*, 444; *acute form*, 445; *subacute form*, 446; *meningo-spinal meningitis*, 447; *latent form*, 448; *chronic meningitis*, 453; *acute hydrocephalus*, 454; *chronic hydrocephalus*, 454; *hypertrophy of the brain*, 457; *atrophy of the brain*—*adensity of the brain*, 458; *tumour of the brain*, 460; *tumours of the cerebellum*, 462; *of the pons*, 462; *local ganglia and infarct spots*, 465; *of the cortex*, 466; *of the fissural lobe*, 466; *cerebral abscess*, 467; *cerebral hæmorrhage*, 470; *post-mortem hæmorrhage*—*birth palsy*, 471; *cerebral hæmorrhage occurring after birth*—*acute cerebral palsy*, 472; *medullary hæmorrhage*, 470; *evulsion*, 460; *thrombosis of the cerebral sinuses and veins*, 483; *arteritis*—*softening*, 484.

CHAPTER XXI

DISEASES OF THE NERVOUS SYSTEM (*continued*)

Chorea, 481; *hemichorea*, 487; *epilepsy*, 497; *hysterical fits*, 499; *post-hemiplegic epilepsy*, 499; *infantile convulsions*—*asthenia*, 500; *irrit.*, 507; *pyramidal*, 509; *head-ringing*, 509; *head hanging*, 509; *hysteria*, 510; *hæmichorea*, 512.

CHAPTER XXII

DISEASES OF THE NERVOUS SYSTEM (*continued*)

Speech anomalies, 515; *dis-mutism*, 516; *acquired deaf-mutism*, 517; *physical defects in the mouth*, 517; *mental defect*, 518; *aphasia*, 518; *stammering*, 518; *mental afflictions in oldhood*, 519; *congenital groups*, 520; *developmental idiosy*, 521; *acquired or acquired*, 521; *catatonic idiosy*, 521; *lunatic children*, 522; *idiocy due to syphilis*, 524.

CHAPTER XXIII

DISEASES OF THE NERVOUS SYSTEM (*continued*)

Spiral palsy, 527; *neuritis*, 528; *quintal meningitis*, 534; *paralysis*, 534; *myelitis*, 536; *Lambert's paralysis*, 537; *hereditary ataxic paraplegia*—*Friedrich's disease*, 538; *anterior poliomyelitis*—*acute atrophic paralysis*—*infantile paralysis*, 539; *peripheral neuritis*, 545; *muscle hypertrophic paralysis*, 545; *juvenile form of muscle atrophy*, 546; *muscle atrophy of the foot*, 548; *Hansen's disease*, 549.

CHAPTER XXIV

DISEASES OF THE GENITO-URINARY SYSTEM

Congenital anomalies of the kidneys, 550; Addison's disease—hyperadrenia of the suprarenals, 550; hematuria, 550; acute pyelitis, 551; lithemia, 552; tumors of the kidneys, 552; tuberculous kidney, 553; hydronephrosis, 557; renal colic, 557; acute nephritis, 558; septic nephritis, 559; acute parenchymatous nephritis, 559; chronic nephritis, 560.

CHAPTER XXV

DISEASES OF THE GENITO-URINARY SYSTEM (continued)

Stones in the bladder, 564; cystitis, 566; incontinence of urine, 567; retention, 569; malformations of the genito-urinary organs—extroversion of the bladder, 570; epispadias, 572; hypospadias, 573; phimosis, 575; balanitis, 576; congenital paraphimosis, 577; retractoritis, 577; ulcers of the urethra, 578; diseases of the external genitalia in females, 578; aphthous vulvitis, 579; monympionia, 579; leucorrhœa, 580; abnormalities in the descent of the testicles, 580; hypernephrosy (tumors), 583; congenital displacement or hernia of the ovary, 584; acute orchitis, 584; syphilitic testis, 585; tubercular disease, 585; tumors of the testis, 585; hydrocele, 586; hydrocele in girls, 587; varicocele, 588; ovarian tumors, 588.

CHAPTER XXVI

DISEASES OF THE BOWEL

Diseases of the bowels, 589; acute peritonitis, 590; chronic peritonitis, 598; syphilitic peritonitis, 599; acute enteromyelitis, 601; acute enteritis, 602; chronic catarrhoid enteromyelitis, 604; chronic diffuse enteromyelitis, 606; stramonium diarrhea, 609; syphilitic dysentery, 611; leontineux stool, 611.

CHAPTER XXVII

DISEASES OF THE JOINTS

Tubercular disease of the shoulder, 605; disease of the elbow joint, 605; of the wrist, 612; of the ankle, 615; acute synovitis, 609; pyogenic joint disease, 609; rheumatic synovitis, 620; chronic rheumatic arthritis, 620; syphilitic synovitis, 621; acute suppurative arthritis of ischuria, 622; acute tubercular synovitis, 624; sacro iliac disease, 625; disease of the temporo-mandibular joint, 627; hysterical joints, 628.

CHAPTER XXVIII

HIP DISEASE

Hip disease, 622.

CHAPTER XXIX

SPINAL DISEASE

Cases of the spine, 564; crani-vertebral disease, 577.

CHAPTER XXX

CLUB-FOOT, DEFORMITIES OF LIMBS, ETC.

Talipes equinovarus, 675; T. valgus, 680; T. varus, 689; flat-foot, 689; wry-neck or torticollis, 691; flaccidities of muscles, 693; hemiparesis, 695; various congenital malformations, 694; supernumerary digits, 696; flat-hand, 697; web-fingers, 698; congenital rigidity of joints and contractures, 699; congenital dislocations, 700.

CHAPTER XXXI

DISEASES OF THE NOSE

Acute rhinitis, 703; chronic catarrh, 705; nasal polypus, 709; malformations, 708; epistaxis, 709; nasal deformity, 706.

CHAPTER XXXII

DISEASES OF THE EAR

Diseases of the external ear, 707; affections of the external meatus, 707; inflammation of the middle ear, 708; of the labyrinth, 711; intracranial abscess, 714.

CHAPTER XXXIII

TUMORIAL GROWTH IN CHILDHOOD

Sarcoma, 715; scirrhus, 716; carcinosarcoma, 715; exosarcoma, 716; cystic tumours, 716; fatty growths, 717; giant-foet., 720; compound congenital tumours, 721; congenital sacral tumour, 722; lymphoma, 724; cystic growths of the jaws, 729.

CHAPTER XXXIV

DISEASES OF THE THYROID AND THYMUS

Acute enlargement of the thyroid, 726; goitre, 726; thymoma, 747.

CHAPTER XXXV

DISEASES OF THE SKIN

Eczema, 729; impetigo, 735; scabies, 737; erythematous eruptions, 737; measles, 738; erythema multiforme, 738; chilblains, 738; erythema nodosum, 739; urticaria, 739; urticaria papulosa, 740; lichen scrofulaceus, 740; psoriasis, 740; pityriasis rubra, 741; miliaria—miliaria, 741; miliaria rubra, 741; pomphigus, 741; dermatitis, 741; drug eruptions, 742; tinea tonsurans, 742; tinea circinata, 743; alopecia areata, 743; leprosy, 743; scabies, 743; simple ophthalmia, 745; squelid maligna, 746; herpes, 746; papilloma, 747; hairy and pigmented moles, 747.

CHAPTER XXXVI

INJURIES, SHOCK, HÆMORRHAGE, ETC.

Injuries to the head, 748; traumatic cephal hæmorrhage, 748; fracture of the base of the skull, 749; injuries of the chest, 749; lesions of the abdomen, 749; injuries of the limbs, 750; greenish fractures, 750; ununited fractures, 750; separation of the epiphyses, 751; primary amputations, 751; primary resections, 751; dislocations, 759; burns and scalds, 760; shock, 761; loss of blood, 761; pain, 761; septic diseases, 762.

CHAPTER XXXVII

ANÆSTHETICS FOR CHILDREN

Local anæsthesia, 764; cocaine, 764; various salts, 764; chloroform, 764; ether, 765; A. C. E. mixture, 765; the choice of an anæsthetic, 765; preparation, 765; vomiting, 767; anæsthesia in special operations, 768; accidents, 770.

APPENDIX 771

FORMULÆ 781

INDEX 785

LIST OF ILLUSTRATIONS

1.	Stomach of a newly born infant (natural size)	1
2.	Lower jaw of an infant at birth, showing dental arch	12
3.	Lower jaw of a child about three years of age	13
4.	Meningeal herniography in an infant	18
5.	Double cephalohematoma	23
6.	Suction of a cephalohematoma	24
7.	Section of an ileocolic diverticulum	30
8.	Boots for allowing infant to stand	47
9.	Infant's feeding bottle	53
10.	Fungus of throat	61
11.	Deficiency of mouth due to cleftness of lip	95
12.	Vertical section of human skull	60
13.	Temperature chart of epidemic typhus	91
14.	Hypertrophic constriction of stomach	107
15.	Throat worm	109
16.	Eggs of throat worm	110
17.	Endo-cerebral infestation	120
18.	Scheme of lines of cures of face	137
19.	Double incomplete hare-lip	158
20.	Severe double hare-lip	160
21.	Diagrams of hare-lip operations	162
22.	Macrosoma	166
23.	Supernumerary article in neck	175
24.	Anatomy of child's trachea	195
25.	Harker's tracheotomy tube	202
26.	O'Dwyer's intubation apparatus	207
27.	O'Dwyer's trachea	207
28.	Temperature chart of lobar pneumonia	211
29.	" " acute fatal lobar pneumonia	214
30.	" " a case of acute lobar pneumonia	215
31.	" " suppurative pneumonia	223
32.	" " " " treated with cold bath	229
33.	" " pleuropneumonia followed by empyema	237
34.	Deficiency of chest due to atresia	244

83. Congenital syphilis	431
84. Distortion of the nose in congenital syphilis	432
85. Diseases of bone in congenital syphilis	433
86. Syphilitic epiphyseitis	434
87. Teasing of "Cherry-Spots" respiratory	442
88. Chronic leptencephalus	455
89. " " "	456
90. Sclerosis of brain	458
91. Atrophy of the left side of the cerebrum	460
92. Transverse section of the cerebrum	460
93. Spastic paralysis	471
94. Basitis of tentorium in spastic paralysis	471
95. Section of brain, showing third ventricle	473
96. " " "	475
97. Brain, showing effects of old meningeal hemorrhage	478
98. Medulla, showing hemorrhage	480
99. Transverse section of medulla, showing hemorrhage	480
100. Section of brain, showing effects of embolism	481
101. Cyst formed in brain as the result of embolism	482
102. Tetany	508
103. Crani	522
104. " "	523
105. A case of curved spina bifida, with talipes	525
106. Section through a spina bifida cured by ligature	528
107. Spina bifida case of spina bifida	531
108. Occipital meningocoele	532
109. Frontal meningocoele	532
110. Pseudo-hydrocephalus paralytic	545
111. " " "	547
112. New growth in the kidney	551
113. Congenital renal sarcoma	555
114. Result of a plastic operation for extrusion of the bladder in a boy	574
115. Undescended testis seen as a swelling in the inguinal canal	581
116. Diagram showing the commoner form of hydrocele of the vaginal process	586
117. Acute periosteitis of the femur	597
118. Overgrowth of the bones of the right leg	597
119. Syphilitic disease of both tibiae	599
120. Epiphyseitis of the upper end of the right humerus	605
121. Multiple tubercular osteitis	610
122. Overgrowth of thumb as the result of tubercular disease	610
123. Results of tubercular osteitis	610
124. Tubercular disease of the wrist	617
125. Tubercular disease of the ankle joint	619
126. Congenital syphilitic ankyrosis of both wrists	621
127. Showing the results of erosion of knee	629
128. " " "	630
129. Showing the results of parietal necrosis of both after operation	651

	Page
130. Splint for disease of the ankle and tarsus	832
131. Resection of the tarsus	833
132. Showing the result of excision of the tarsus	836
133. Diagram showing the parts most frequently affected in hip disease	839
134. Disease of head of femur	839
135. Section of the head of femur, showing disease	840
136. Specimen showing disease of the acetabulum	841
137. Location in hip disease	846
138. Position of the limb in the second stage of hip disease	848
139. Side view of the same	848
140. Bryant's splint	852
141. Method of applying extension in hip disease	854
142. Thomas's hip splint applied	859
143. " " " "	859
144. Result of excision of the leg	860
145. Curves of the spine	865
146. Articulo in spinal column	868
147. Jury-trial for spinal curvatures	872
148. Patterns of Thomas's splints for spinal disease	873
149. Cases of the spine treated with Thomas's splint	874
150. Severe talipes equino-varus	878
151. Very acute talipes equino-varus	879
152. Little's tin splint	884
153. Artificial muscle applied	884
154. Little's tin talipes shoe	884
155. Acquired talipes	888
156. Artificial muscle for flat foot	890
157. Congenital wry-neck	891
158. Artificial muscle for congenital wry-neck	894
159. Double thumb	896
160. Infra-olecranon amputation	896
161. Arrest of development of limb	897
162. Club-hand	898
163. Double club-hand	898
164. Genu recurvatum and talipes calcanei	899
165. Abnormal position in uterus, causing genu recurvatum, &c.	900
166. Congenital dislocation of both hips	901
167. Sarcoma of lower jaw and eyelid	913
168. Eriochondroma of spine and fingers	914
169. Multiple enchondromata of fingers	915
170. Hygroma of neck, with macroglossia	916
171. Congenital serous cyst of back	916
172. Dermoid cyst of orbit	917
173. " " " " forehead	918
174. " " " " in lachrymal space	919
175. Myxosarcoma of breast	921
176. Giant fist	922
177. Congenital cystic tumour of groin	924

178.	Congenital nasal tumour	298
179.	Section of congenital nasal tumour	298
180.	Lymphoma of neck	298
181.	Cystic hemithorax	297
182.	Hairy mole of the face and scalp	247
183.	Separation of the right epiphysis of the right humerus	717
184.	Plan of the development of the humerus	713
185.	Separation of trochlear epiphysis of humerus	714
186.	Area of growth of the radius	714
187.	Separation of lesser epiphysis of left femur	355
188.	Dislocation of the patella	790
189.	Short, large radial tube	276
190.	Ball-up head for granulations	779
191.	New York Orthopaedic Hospital brace for knock-knee and bow-legs	550
192.	Knight's bow-leg brace	550
193.	Dorset Children's Hospital's brace for bow-legs	550
194.	The Davis-Taylor long traction hip-splint	548
195.	Bradford-Coddsworth brace for correcting deformity in the knee	551
196.	Taylor's special brace with chin cup	547
197.	Whitman's flat-foot support	547
198.	Shaffer's flat-foot support	546
199.	Dr. Freeman's plastering apparatus	245
200.		

DISEASES OF CHILDREN

CHAPTER I

THE PHYSIOLOGY OF INFANCY AND CHILDHOOD

The Periods of Early Life.—The life of man is naturally divided into three great epochs—viz. a period of *Growth and Development*, of *Maturity*, and of *Decline*.

The first division includes the periods of early life, when those series of operations are in progress by which the ovum or primitive germ is transformed into the complete organism; it may be subdivided into *Intra-uterine Life*, *Infancy*, *Childhood*, *Youth*, and *Adulthood*.

Intra-uterine Life.—During this epoch the embryo depends entirely upon its parent for all its wants. The maternal blood supplies it with material for constructive purposes, carries away its waste products, and renders unnecessary the maintenance of an independent temperature. It is clearly a time of great importance to the future being, and it is necessary that this development should take place under healthy conditions, inasmuch as it is physiologically impossible for an unhealthy or weakly mother to supply the wants of the embryo, and any failure in the nutritive powers of the maternal blood is certain to leave its stamp on the future development of the child. An infant may come into the world fairly well developed and plump, from the presence of more or less stored-up fat, in spite of the weakly state of the mother's health, but it is almost certain sooner or later to exhibit tendencies to disease in the direction of the stock from whence it springs. Not only may the embryo owe a weakly beaking-up of its tissues to its mother, but it may actually share maternal disease. The fetus may suffer from endocarditis originating in a rheumatic state of its parent, and this lesion affecting, as it usually does, the right side of the heart, may lead to malformations, which are only too likely to cut short its career. From its parents also the fetus may receive the taint of syphilis, from which it may suffer during its embryonic life or after birth. It may receive an inheritance of tuberculosis or epilepsy, or a tendency to gout or rheumatism. During fetal life many anomalies may arise from arrested development or an overgrowth in certain directions; cleft palate and hare-lip are instances of the former, and supernumerary fingers and neural growths of the latter.

Infancy.—The Romans used the word *infans* in its widest sense, and though, as its derivation implies, it was originally applied to those who could

not speak, it came to be employed by them for children of much older years. The terms *infancy*, *puerile infancy*, and *Stagelingsperiode* are most usually applied to the first seven or eight months of life, the time during which the infant is nursed at the breast, and before the eruption of the milk teeth. It is, however, used by some writers to include the whole of the first year. Within the first week or two of life the infant has often to contend with conditions which are peculiar to this period, inasmuch as they depend in one way or another on the act of birth. It may be born asphyxiated in consequence of strangulation by the cord or pressure on the head, or various injuries producing hæmatomas may take place; or there may be septic infection in connection with the umbilical cord. The change from placental alimentation to the digestion of food in the infant's stomach is a time of peculiar danger, especially if artificial food is given, and the mortality of infants is much greater during the first week of life than at any other period.

During the first few months of infancy, life is not so purely vegetative as it is during the intra-uterine period, yet the mental faculties are in abeyance and the movements mostly involuntary or reflex.

One consequence of the undeveloped condition of the higher or inhibitory centres is that the reflex centres are less under control than in later years, so that disorderly reflex movements in the form of convulsions are liable to take place on the slightest provocation. Growth at this period is extremely rapid, the weight more than doubling itself during the first six months of life, and a great strain is thus thrown on the alimentary system; the lymphatic and blood-forming organs are also exceedingly active. It is not surprising, therefore, that the diseases which are most common and fatal at this period are those connected with digestion and absorption. The infant requires much rest, and, indeed, divides its time for the most part between feeding and sleeping. It is during this period that 'wasting,' 'marasmus,' or 'atrophy' is so common, a result of chronic catarrh of the intestinal tract and a consequent impairment of the digestive organs.

Childhood.—The eruption of the milk-teeth marks an epoch in early life, the term *childhood* being applied to the period commencing with the first dentition and ending with the commencement of the second, at the sixth or seventh year. The terms *puerile infancy* and *Kindesalter* are used in a similar sense. Growth at this period continues to be active, though not proceeding at the same rate as during infancy, but disturbances of the alimentary system are common, and children quickly waste if digestion and absorption are interfered with.

The nervous and muscular systems are developing so that by the end of the first year the child can crawl or even walk with help. It is at the commencement of this period that rickets, a disease so intimately associated with indigestion, often makes its appearance. The mental faculties are opening out as the brain develops, and the infant begins to recognise its friends and call them by name. During the period of dentition nervous disturbances are common, and the febrile condition giving rise to infantile paralysis are apt to take place.

Youth.—The terms *youth*, *puerile* and *Kindesalter* are generally applied to the period commencing at the second dentition and ending at puberty, or

about the fourteenth year. During this time the milk teeth are replaced by the permanent set, the bones become more solid and the muscles better developed, while the mental faculties are exceedingly acute and the mind readily acquires knowledge. As puberty approaches the voice becomes deeper and the sexual organs undergo a marked increase of development. During this period, in which scholastic education is carried on, the memory is exceedingly retentive, perhaps more so than at any other time. Children at this period easily "outgrow their strength," the nervous system is readily upset, as is evidenced by the frequency of chills, and the alimentary canal is apt to suffer from chronic catarrh.

Respiration.—During intra-uterine life the respiration of the fetus is carried on by means of the placenta. The blood of the fetus—as far as oxygen is concerned—is supplied in a far more imperfect manner through the maternal blood, than when after birth the oxygen is taken direct from the air in the vesicles of the lungs. Inasmuch as the fetus has no independent temperature to maintain, and its life is spent in continuous sleep, its tissues require far less oxygen than it does after birth. This condition of things induces a tolerance of oxygen starvation, much greater than in adults, thus frequently stands it in good stead during the act of birth, when the placental circulation is perhaps interfered with through pressure on the umbilical cord, and pulmonary respiration as yet is not possible. Infants are often born in a condition of asphyxia, especially after severe labours, and have been known to survive without either placental or pulmonary respiration for 10 to 15 minutes, and infants may live for many hours, or even days, with the greater part of their lungs in an unexpanded state. The same tolerance of a various condition of blood occurs in other newly born animals; thus Brown-Sequard has shown that a newly born mouse will recover after 10 minutes', and a newly born guinea pig after 12 minutes' immersion in water, while an immersion of 5 to 35 minutes is fatal to the adult animals.

In the newly born the respirations amount to about 44 per minute; during the early months of life they vary from 35 to 40 per minute; at the end of the first year and commencement of the second they have fallen to about 28; during the third and fourth years they are about 25; by the fifteenth year they have fallen to 20; in the adult they vary from 16 to 20. Infants and children, as might be expected, give off absolutely less carbonic acid than do adults, but relatively more.

The absorption of oxygen is also relatively greater in childhood than in adult life; the oxygen in the exhaled carbonic acid does not represent all the inhaled oxygen, the proportion retained being greater in childhood than in adult life.

In the infant and during the first three years of life the type of respiration is the abdominal, the diaphragm being the chief muscle used in tranquil respiration, the abdomen rising and falling, and the ribs moving but little. Later the costo-inferior type is present, respiration takes place both by the raising of the upper seven ribs by the intercostals, and also by means of the diaphragm, the chest expanding and the abdomen moving slightly.

In girls towards puberty the costo-superior type is present, the upper part of the chest moves freely, the lower part and the abdomen hardly at all.

The vital cubic capacity of the lungs is smaller in proportion to their

height in children than in adults. This is due in part to the relative smallness of their lungs and to the greater elasticity and flexibility of their chest walls.

According to Schaeff and Wernick the vital cubic capacity at different ages is shown by the following table :

3 to 4 years	about 450 c.c.	11 to 12 years	about 1,800 c.c.
5 to 7 "	" 600 c.c.	13 to 14 "	" 1,900 c.c.
8 to 10 "	" 1,200 c.c.	In adults (average)	3,000 c.c.

With regard to the amount of carbonic acid given out by children, the following account of an experiment made by the late Dr. Angus Smith, of Manchester, is of interest. We quote his own words: "Four children, three boys of 6, 7, and 8 years respectively, and one girl of 7, were put into the lead chamber which was made for similar experiments, and in order to observe them more carefully Dr. Ashby sat beside them. They were extremely quiet, and the amount of carbonic acid given out was exactly one-half of that which experiment had given me in previous years for a healthy man of moderate strength. The amount given out by Dr. Ashby was estimated in a separate experiment, and subtracted from that given out by the children, which was equal in amount to eight of a cubic foot per hour for each.

"The children were then put in by themselves and became very restless and active, causing the carbonic acid to rise up for each to 0.531 of a cubic foot. They were then put in again and requested to be very quiet. They had a few cards to play with, and talked a great deal, but were bodily pretty still, upon which the carbonic acid fell down nearly to the first amount—viz. 0.4793 of a cubic foot.

"We find that talking raised the amount of carbonic acid only 0.0529 of a cubic foot, whilst jumping and laughing raised it 0.1687, or about three times as much."

Changes in the Circulation after Birth.—The cessation of the placental circulation, the inflation of the lungs with air, and consequently the increased amount of blood passing through the pulmonary artery, lead to a gradual shrinking and obliteration of the various fetal passages—viz. the vessels of the cord, the ductus venosus, ductus arteriosus, and foramen ovale. These changes commence after the first few respirations have been taken, and within a week or ten days these passages are closed. Not infrequently, however, one or other of them remains open for a much longer period, this being especially true of the foramen ovale. In 60 cases under 2 years of age noted by Parrot, it was only completely obliterated in 4; and of 32 cases between 2 and 9 years, in 25 only was it completely closed.

With regard to the ductus arteriosus, Parrot found that of 317 cases of 1 month to 3 years, in 46 it was open, in 18 it was partially closed, and in 153 it was obliterated. The ductus venosus is mostly obliterated within three days; according to Quincke its remaining partially open gives rise to icterus.

Blood.—During the last few years, many observations have been made of the blood of the newly-born and also of young infants, with the object of determining the differences as regards the number and character of the corpuscles as compared with adults. The results of various observers are

in some cases at variance, and some care is required in drawing conclusions. The results given must not be taken as being universally correct. The nucleated red blood corpuscles found during the early months of intra-uterine life are only very exceptionally to be seen in the blood of the newly born when born at full time. The red corpuscles are more numerous in the newly born (5,000,000 to 6,000,000 per cfm. mfl.) than in the adult, and also very more in size (Hayem). In a few weeks this disparity in numbers disappears. The quantity of Hb is also greater in the newly born (Leichenstern). The leucocytes are also both relatively and absolutely more numerous; the greater number are of the small mono-nuclear variety (lymphocytes). The eosinophile cells are also increased (Kautbach).

The amount of fibrin formers appears to be less as coagulation occurs less completely.

The amount of blood in the body is relatively less than in adults, being one-nineteenth of the body weight, while in the adult it is one-thirtieth (Weicker).

In older children in health the blood does not appear to materially differ from the blood of adults.

Pulse.—At the end of fetal life the number of cardiac contractions per minute is about 132 in boys and 140 in girls; in the newly born infant it has fallen to 130 to 135. According to some observations, the pulse rate falls notably immediately after the ligation of the cord, to regain its normal number an hour or two later. During the week succeeding birth it varies from 120 to 140, crying immediately increasing the number some 10 to 30 beats. By the second year it has fallen to 110, by the fifth to 100, by the eighth year to 90, and by the twelfth to 80.

During sleep the pulse rate is diminished, especially in infants, sometimes by as much as 10 or 20 beats. The pulse is more often irregular in infants and children than in adults, and this apart from the influence of disease.

According to Seltman the inhibitory action of the vagus is less marked in newly born animals than in adults. The circulation of the blood in infants and children is carried on more rapidly than in adults, and consequently the tissues are supplied with a superabundance of arterial blood. The tension in the arteries is comparatively low, on account of the relatively large size of the aorta and arterial system generally.

According to Vierordt a complete circulation takes

In newly born infants	22 seconds	(134 pulse rate)
At two years	15	107
At fourteen years	18.6	87
In adults	22	72

On account of the progress of the pulse to be influenced by excitement during infancy, it is of less value in diagnosis at this period than in later years.

Alimentary Canal.—For the first six to eight weeks of life there is very slight secretion of saliva, only sufficient being formed to render the mouth moist. In the third and fourth months the secretion is much more free, so that infants about this period begin to dribble; the amount of secretion becomes still larger as the period of dentition approaches. By the third or fourth month the saliva contains ptyalin, and readily converts cooked starch

immature. The stomach of the newly born infant is small, its capacity being one or two fluid ounces, by the end of the fourth week from three to four ounces, at three months about five ounces, and at the end of the first year ten ounces. The muscular layers of the stomach and intestines are at first only slightly developed, hence the feebleness of the peristaltic action and the tendency to the accumulation of gases in both the stomach and bowels. The gastric juice has at first but imperfect digestive powers, and the stomach is in consequence quickly exhausted; the peristaltic action of the walls of the stomach is often very vigorous, and may give rise to the regurgitation of the food swallowed, especially as the cardiac sphincter is weaker and more easily gives way in infants than in adults. For the first few months the digestive powers of the pancreatic and intestinal juices are exceedingly feeble, so that starches and portions of curd of cow's milk will pass through the whole of the intestines unchanged. The secretion of bile begins at an early period of fetal life, probably about the third month; the bile accumulates in the small intestines and is passed as the meconium during the first few days after birth. It forms dark brown or greenish masses,



Fig. 1.—Stomach of a Newly Born Infant (normal size).

viscous and tenacious, and of a feeble and inactive, and consists of mucus holding in suspension fatty matters, epithelial cells, biliary pigments and cholesterine, but no bile-acids. Three or four days after birth the meconium is succeeded by the golden yellow semi-liquid stools characteristic of the healthy infant. This yellow colour is due to the bili-rubin of the bile; the green colour sometimes seen in intestinal catarrh depends upon the oxidation of the bili-rubin and formation of bili-verdin. Under normal circumstances newly born infants have two or three stools daily. Their character gradually changes as the infants get older, becoming more and more like the stools of adults.

Urine. The newly born infant generally passes water within 24 hours of its birth and continues to do so some 10 or 12 times daily, passing about 1 oz. at a time, or about 10 oz. in 24 hours. The first urine passed is cloudy from the presence of uric acid and epithelial cells, and is of specific gravity 1005-1006; later it becomes clear and of a light straw colour. It contains more uric acid and less urea (about 5 per cent.) than does that of adults.

During the whole of childhood the urine is of a paler colour and lower

specific gravity than during adult life; smaller quantities are also passed, but on account of the difficulty of collecting the total quantity the amounts have not been accurately determined. The following figures may be taken as approximate:

Between 2-5 gms. about 12-15 cc.	containing 5-14 grammes of urea (in 24 hrs.)
" 5-9 " " 25-35 "	" 14-19 "
" 10-14 " " 35-45 "	" 19-24 "
Adults " 20 " " 30 "	" " "

Temperature.—The temperature of an infant at birth taken in the rectum is about 100° F. (37.75° C., Reber, Sommer). A few minutes after birth it sinks to 97°, or in weakly infants still lower; in the course of a few hours it again rises and remains at about 98.8° F. This temperature or a fraction of a degree higher—98.8-99° F.—may be taken as the normal rectal temperature during childhood and youth. For young children, if exact observations are required, the rectum is the best place to insert the thermometer, as it is difficult to keep the infant quiet with a thermometer in its naris. It is important to remember that the rectal temperature exceeds that of the axilla by about 1° F. For most clinical observations the fold of the groin or the axilla may be taken. What is also of importance is the time at which it is taken. According to the careful researches of Finlayson, the diurnal range of temperature amounts to about 2° F., the maximum being at 5 to 6 P.M. and the minimum in the small hours of the morning; the range of temperature in adults being somewhat less.

According to Reiss, the lowest temperature is between 4 and 5 A.M., increasing to 11 A.M., falling to 2 P.M., then rising to its diurnal maximum at 6 P.M.

The most recent observations upon the temperature of children in health were made by the late Dr. O. Sturges. The most interesting of these were made upon two sturdy children living in the country, aged respectively 1 year and 2 years. The temperatures were taken at various hours from 10 A.M. to midnight, the usual range being 97.4 to 98.6. The highest temperature was after breakfast, when the children were most lively and eager for play.

The heat of the body is maintained with greater difficulty during infancy than in later life, a result due not only to the relatively larger surface, but also to the much greater vascularity of an infant's skin. Infants and children are much more liable to suffer from cold extremities than are adults.

Nervous System.—The closure of the anterior fontanelle takes place towards the end of the second year in strong and vigorous children; in immature and sickly children it may be delayed till the third year, or it may be later.

The cubic capacity of the skull in newly born infants is about one-third that of adults, viz. 300 c.c.; by the second year it is about 1,000 c.c., while in the adult it is about 1,500 c.c. The brain of a newly born infant forms about 14 per cent. of its body weight, while in the adult it is only 2.37 per cent. The brain doubles its weight during the first year of life (14 cc. to 28 cc.); by the seventh year it has reached 38 cc.; by the fourteenth or sixteenth year 47 cc. to 49 cc.; the average brain weight of an adult (male) being about 50 cc. The cerebellum after birth develops more quickly than other parts of the brain, the frontal lobes more slowly till six years of age, when they develop rapidly.

If the brain of a newly born infant be examined, it will be noted that its

consistence is much less firm than is that of an adult's, and it is much more readily injured. If placed on a plate it spreads itself out or moulds itself into any shape more readily than an adult's brain. The pia mater is exceedingly delicate and very easily dissected off with a pair of forceps. In colour the brain is light grey, often yellowish from the presence of bile pigments; there is no well-marked difference between the 'grey' and 'white' substance as in adult brain, and the convolutions are less distinctly marked. The multipolar cells in the grey matter on the surface are ill developed, as also is the pyramidal bundle of nerves which connect them with the basal ganglia and internal capsule; on the contrary, the nerve elements of the cord and spinal nerves are well developed.

From the above facts it is clear that while the excito-motor centres in the spinal cord and medulla are well developed at birth, the higher centres on the surface of the brain are imperfect, and so also are the strands or nerve-paths which connect the higher and lower centres. This agrees also with the experiments of Soliman, who has shown experimentally that the application of some form of irritation, as the induced current, to the surface of the brains of newly born animals does not evoke movements in the face and limbs as it does in adults. The actions of infants—sucking—crying—swallowing—breathing—are reflex, and inasmuch as they are uncontrolled by the inhibitory influence of the higher centres, are apt to be disorderly and excessive: as, for instance, in convulsions. The reflex actions displayed by a brainless frog are more violent and vigorous than those displayed when the brain is intact. The readiness with which the newly born infants become convulsed is one of the most remarkable features in early life. Hereditary influences play an important part, infants coming of a nervous stock being much more prone to convulsions from slight exciting causes than others. As the higher centres develop, changes come over the mental character of the infant, and the reflex actions become more and more under control and dominated by the psychical centres. The movements of newly born infants are almost entirely reflex, though certain 'spontaneous' or 'impulsive' movements, such as stretching the limbs, occur.

Sight.—In the first week after birth the infant apparently cannot distinguish objects, but can light from darkness. According to Freyer's examinations, the movements of the eyes are not co-ordinated at first. Kneigstein, from an examination of 100 newly born infants, states that they were all hyperæsthetic. The colour of the iris is bluish-grey or green, but one finds also shades of light grey and brown. The same investigator has also noted blood extravasations in the retina, which disappear in a few days. The pupils are very large in the newly born, and sensitive to light; in later childhood they can endure strong light better than can adults. Of the colours, children learn first to distinguish white from black; in the second year they learn to distinguish other colours, first red and yellow, later green and blue.

Hearing.—In the newly born the mucous membrane of the tympanum is swollen so that no cavity is present, consequently they are not very sensitive to sounds, but dull and strong sounds make impressions, the infants waking with cries. In the first months children hear high and sharp sounds better than deep. Older children can hear very weak and high sounds which make no impression on adults.

Taste.—Newly born infants can distinguish sweet, bitter, sour, and salt tastes.

Psychical Phenomena.—In the second month an infant learns to hold up its head and make voluntary movements and to distinguish the voices of its friends. At the 3rd or 4th week it can laugh, and smile when caressed. In the 3rd to 4th month the infant notices its toys or anything it can hold in its hands, mostly putting them to its mouth. At 7 to 9 months the child can sit up, and 3 or 4 months later makes attempts to walk; when a year old well-developed children can walk a few steps without help. From this time the child begins to say a few syllables, such as *tá-tá, dá-dá, hē-hē*, without much notion of applying them; then words are learnt, and by the end of the second year most children can string a few words together.

Sleep.—The newly born infant sleeps all day except when it wakes up for food. At a year old the infant sleeps fifteen to sixteen hours; from 2 to 3 years, twelve to thirteen hours; from 4 to 5 years, no sleep in the day, from ten to eleven hours at night; from 12 to 13 years, eight to nine hours. Infants sleep lightly and are easily awakened; at 4 to 5 years of age they are generally heavy sleepers.

Body Weight.—An infant born at full term weighs from 6½ to 7½ lb., 7 lb. being an average weight. For the first two or three days of life there is a loss of 4 oz. to 7 oz., then a regular gain, so that by the 5th or 6th day the initial loss has been made good. According to Gregory, the following figures express the average daily loss and gain during the first six days of life:

1st day	loss of 139 grammes or nearly 5 oz.
2nd "	" 64 " " 2½ "
3rd "	gain of 33 " about 1 "
4th "	" 50 " " 1½ "
5th "	" 50 " " 1½ "
6th "	" 36 " " 1¼ "

That these figures are by no means universally correct is clear from the difference in weight noted by different observers; thus, according to Lewis Smith, in 170 infants born in the New York Infant Asylum (83 male and 87 female), the average weight of the boys was 7 lb. 11 oz. and the girls 7 lb. 4 oz. Fifty of these were sex-trained, and weighed when one week old, with the following result:

Increase of weight in	32 cases
Loss	15 "
Average gain	4.8 oz.
" loss	3.5 "
Greatest gain	12 "
" loss	6 "

Growth during the first year, more especially during the first six months, is extremely rapid, the infant doubling its weight in the first six months and trebling it during the first year. Many observations have been made on the weights of children during the first year; the following table exhibits the monthly gains, being the average of nine infants observed by W. F. Fother, who

were nursed at the breast at first, and later this was supplemented with *cows' milk*.

Age	Monthly gain	Weight at end of the month
1st month	13½	5 3½
2nd "	20½	10 4
3rd "	16½	13 13
4th "	20	15 9½
5th "	21	18 14½
6th "	21	19 3½
7th "	17	17 5
8th "	21	18 10
9th "	23	20 1
10th "	20½	21 5½
11th "	11	22 0
12th "	7	22 2

Growth after the end of the first year is slower, so that the weight is not again doubled till the end of the sixth year, and doubled again by the end of the fourteenth.

Length.—The average length of a newly born infant is 20 inches; it has doubled its length by the end of the fourth year.

Much interest and importance is attached to the increase of weight and height during infancy and childhood: weekly weightings, especially during the early months of life, give very valuable information with regard to diet. It must, however, always be borne in mind that increase in weight, especially if it be due to an accumulation of fat, does not always indicate strength, or that the food being taken is a *valuable* one. During childhood, undergrowth or loss of weight must be looked upon as an indication of danger and as evidence of malnutrition. On the other hand, overgrowth without a proportionate increase in weight should always be taken as indicative of weakness.

For farther information on this subject, the reader is referred to the '*Life History Album*' by Francis Galton.

The following is a proportionate table of height and weight:

Height	Weight	Height	Weight	Height	Weight
14	18	17	32	39	62½
15	19½	18	40	40	65
16	21	19	42	41	67½
17	22½	20	44	42	70
18	24	21	46	43	72½
19	25½	22	48	44	75
20	27	23	50	45	77½
21	28½	24	52	46	80
22	30	25	54	47	82½
23	31½	26	56	48	85
24	33	27	58	49	87½
25	34½	28	60	50	90
26	36				

It is not only of interest, but it is important, to both weigh and measure children at frequent intervals. Periods of under or over growth are periods of danger, as indicating either malnutrition or an overtaxing of the strength. There should also be maintained a close relation of height to weight.

Dentition.—At birth the jaw contains the dental sacs with the already calcified crowns of the temporary teeth. Besides the temporary teeth, there is the calcified crown of one of the permanent set, the first molar, which is situated immediately behind the last temporary molar. (See fig. 2.)

During the interval which elapses between birth and their eruption, the teeth are undergoing farther development; the sacs become enlarged, so that they are readily felt through the gum as rounded swellings, the edges of the teeth become sharper, and the fangs are developed. As the fangs elongate, the edge of the tooth comes nearer to the surface of the gum, the latter swells



Fig. 2.—Jaw of a Child at Birth, showing the Dental sacs (Quain's "Anatomy" 3, 4). The left half seen from the inner side; the right half seen from the outer side; the incision by which the jaw has been removed to expose the dental sacs. *a* shows the sac of the temporary set and the sac of the first permanent molar behind the posterior molar of the milk set. *b* shows the same, and also the sac of the permanent incisors and canines.

and becomes more vascular, the edge of the tooth appears as a line of pain beneath the membrane, which finally becomes perforated, and the tooth is cut.

The temporary set appear for the most part in groups in the following order. **First group**—The lower two central incisors appear from the 6th-8th month, followed by a pause of from three to six weeks. **Second group**—The four upper incisors are cut at intervals of a week or two, from the 8th-10th month, followed by an interval of one to three months. **Third group**—The lower lateral incisors, the upper and lower front molars appear at intervals from the 12th-14th months, followed by a pause of two to three months. **Fourth group**—The canines appear, the upper ones usually being first, from the 18th-20th months. **Fifth group**—The posterior molars usually appear at the age of 2-2½ years.

The milk set, when complete, remain unchanged for several years, though

the permanent set are gradually becoming developed in their *sockets*, ready to replace the confer set.

The following formula exhibits the relation between the temporary and permanent set:

		inc.	ca.	cl.	m.	ca.	mo.	
Temporary set	Upper	2	1	2	2	1	2	
	Lower	2	1	2	2	1	2	
		inc.	lc.	ca.	in.	in.	ca.	mo.
Permanent set	Upper	3	2	1	2	2	1	2 = 16
	Lower	3	2	1	2	2	1	2 = 16

20

32

At six years of age there are a greater number of teeth in the jaws than at any age, there being the milk set and all the permanent set except the wisdom teeth.

It is to be particularly noted that during this period a marked increase takes place in the length of the jaw to provide room for the three molars of



Fig. 3.—Lower Jaw of a Child of about three years, showing the relation of the temporary and permanent teeth. The milk teeth of the right side and incisors of the left are shown, and also the roots of the permanent set, except the wisdom teeth, which is not yet formed. The large jaw near the roots of the jaw is that of the first permanent molar, and above and behind it is the rudiment of the second molar. (Quain's *Anatomy*.)

the permanent set, which make their appearance posteriorly to the milk set; the incisors replace the temporary molars (see Fig. 3).

While the above account represents the state of things which obtains under normal conditions, yet important deviations both as to the time of the appearance of the teeth through the gum and the condition of the teeth themselves frequently take place as the result of disease or enfeebled nutrition. It is well known that rickets is the most common cause of delayed dentition, and not only are the teeth cut later than usual, but the defective nutrition which exists in this state frequently interferes with the development of the teeth; they may in consequence be dwarfed or provided with a thin or partially deficient layer of enamel, so that they quickly become carious after being cut.

The jaw of the infant at birth contains the calcified crowns of all the milk

teeth and also the calcified crown of one of the permanent set, namely, the first or 'six-year-old' molar, which commences to calcify during the sixth month of intra-uterine life. The calcification of the permanent incisors commences when the infant is about a month old, the canines at 3 or 4 months of age and the bicuspids later, in the first or second year. The crown of the second permanent molar begins to calcify during the fourth or fifth year, but the wisdom tooth not till about puberty.

It is plain, therefore, that any illness occurring during the first year, such as syphilis, can only affect the calcification of the incisors, canines, and possibly the bicuspids. (See Second Dentition, p. 18.)

The permanent teeth are cut in the following order:

Molar, first	6 years of age
Incisors, central	2 " "
" lateral	2 " "
Bicuspids, anterior	2 " "
" posterior	2 " "
Canines	11-12 " "
Molars, second	12-13 " "
" third	17-25 " "

Mortality in Infancy and Childhood.—In this country, out of every 1,000 children born, on an average 145 die before the end of their first year of life and 205 before the age of 5 years. During the next five years, from 5 to 10 years of age, 35 die, and 18 more between the ages of 10 and 15 years. So that out of the original 1,000, 684 will be alive on their fifteenth birthday and 516 will be dead. From these figures it is clear that the mortality is the greatest during the first year, and that it rapidly declines as childhood advances. Indeed, the mortality is the greatest during the first day and succeeding days after birth; thus Kérosi, in analysing the ages of infants at death, found, out of 26,625 infants born in Pesth during the years 1874 and 1875, that out of every 1,000 born, 13 died within 24 hours; 57 on the second day; 347 during the first week; 265 during the second week; and 92 during the first month.

It appears that infant mortality is slowly decreasing in this country, though at a much slower rate than adult mortality. Thus in England and Wales the mortality during the decades 1851-60 and 1861-70 was equal to 154 per 1,000. In the years 1871-80 it declined to 129, while in 1881-90 it was 122.

The mortality of infants differs enormously, and is dependent upon the amount of care which is taken in their feeding, and the way in which they are looked after, as well as upon their parentage. Roughly speaking, it may be said that among the rural population of Great Britain, and among the well-to-do dwellers of suburban districts, the annual infant mortality amounts to 100 per 1,000, 600 out of every 1,000 children born being alive at the end of the first year. This is the average infantile death rate of Norway, which is the lowest of any European country, and, indeed, probably in the world.

In a large city, such as Manchester or Liverpool, the annual death rate among infants under a year is 200 per 1,000 births, or, in other words, one-fifth of those born never reach the end of their first year. In the worst and

most crowded districts there is little doubt that the mortality is at least 300 per 1,000, one-third of those born never living to become a year old. A still higher death rate prevails among the unfortunate class of illegitimate children; the mortality among these amounts at times in some districts of our large cities to 400 per 1,000, not more than half living to be a year old. Indeed, the mortality has in some districts risen, as in Salford, to 710 per 1,000.¹

In London the rate of infant mortality is about the same as that of the country generally, namely, 150 per 1,000. The mortality is the same in Paris as in London, while in most Continental cities it is higher. In Munich (1884-1886) it averaged 324 per 1,000; in Berlin, 268 per 1,000; in Russia, 266; and in Austria, 255 (Rahn).

As one would naturally expect, child mortality also differs greatly under different circumstances; thus we find in the healthy parts of England the annual mortality of children under five years of age is not more than 30 per 1,000 (living at that age), that is, out of every six children (under five years of age) only one will die during the year; while in the worst districts 100 or even 110 per 1,000 perish annually.

Child mortality is also slowly decreasing in this country. During the ten years 1861-70, the mean annual death rate of children under five years of age was equal to 68.6 per 1,000. During 1871-80 it fell to 61.3 per 1,000; while in 1881-90 it fell to 56.8 per 1,000. This, however, is just twice the mortality given by Ansell's tables, which are based on the experience of child life among the upper classes, namely, 28.2.

Of the causes of death in these cases, it may be taken for granted that diseases of the digestive system play a most important rôle; but statistics are more or less untrustworthy, as the causes of death which appear on death certificates are often not to be relied upon for purposes of classification. Analysing the causes of death from 2,000 cases of infants under two years of age, who died while under the care of the medical officers of our own Children's Dispensary, we found that of the fatal cases those connected with the digestive system head the list, forming 35 per cent. of the total number. Bronchitis and its allies caused death in 21 per cent. of the cases; whooping cough in 12 per cent.; congenital syphilis in 10 per cent.; and measles in 9 per cent.

Among the less frequent causes of death we find tuberculosis, meningitis, diphtheria, and various malformations. We must not forget to mention that pneumonia birth accounts for some deaths that do not figure in our list, and those unfortunately too common cases which are returned as 'found dead in bed.'

Infant mortality should not be calculated, as is sometimes done, by comparing infant deaths with deaths at all ages, or with the number of persons living, inasmuch as in a given population there may be many or few children or few old people, but it should be calculated on the infant population, or the number of children living at that age. Thus the number of deaths in infants under a year old should be compared with the number of infants living at the time, which is usually calculated as the mean of the births in this and the preceding year. In the same way the mortality of children under five years is calculated by comparing the deaths in the year with the number of children living under five years of age.

¹ See Dr. John Tatham's *Mortality Reports for Salford*.

CHAPTER II

THE DANGERS INCIDENT TO BIRTH

THERE are certain lesions which can occur only *once* in a lifetime, inasmuch as they owe their origin to the act of birth, or to those important changes which occur in the life conditions of the infant when it exchanges the quiet dependence of intra-uterine life for the greater activity of an independent existence. Though many of these morbid conditions differ from one another in various ways, yet they are so intimately associated in their pathology and etiology that it is most convenient to discuss them together, rather than to relegate them, as is often done, to their respective places in the ordinary classification of disease. The act of birth brings its own special dangers to the infant as well as to the mother, and it is hardly surprising to find that many perish on the threshold of life, and that the mortality during the first few days after birth is greater than that of any other period. It must also be borne in mind that parturition is not only responsible for many infant deaths, but for damage done to the nervous centres by pressure or hemorrhage, which may be irreparable, and if the infant lives it is paralysed for life, or a hopeless imbecile. These diseases which are connected with parturition are also of much interest and importance, in that many of them are entirely preventable, and are often the result of the ignorance of the friends or neighbours, who, in the absence of a medical practitioner or trained nurse, preside in the lying-in room, or may possibly be the result of "meddlesome midwifery." However this may be, many a life is lost and various morbid conditions arise for want of assistance during the later stages of labour, or for the want of care and cleanliness, or from exposure to contagion during the first few days which succeed birth. We will first consider the effects of asphyxia, so common in newly born infants.

Asphyxia Neonatorum.—It is hardly to be expected that the transition from placental to pulmonary respiration should be accomplished without some risk of the cessation of the one before the commencement of the other. Fortunately for the infant, as we have already remarked, its nervous centres and tissues generally are far more tolerant of a venous condition of blood than they are in after life, for during intra-uterine life the aeration of the blood is far less perfectly performed by the placenta than it is afterwards by the lungs; and, moreover, there is a mixture of the placental blood with the venous blood of the inferior vena cava before it is distributed to the body. (a) The infant may die from this cause before birth, or it may be born asphyxiated; (b) asphyxia may supervene after birth through failure of the pulmonary respiration.

(a) *Asphyxia* before birth is caused by the death or faintness of the mother, detachment of or interference with the placental circulation, or compression of the cord. *Asphyxia* of the fetus may be suspected if the fetal heart becomes faint, the pulsation of the cord ceases or is weak, or if meconium is passed. In infants born asphyxiated the symptoms vary according to the degree of asphyxia present; when slight, the lips are of a bluish tint, the skin dusky, the conjunctivæ injected, the limbs are motionless, but the muscular tissue is present, the heart's action is slow and mostly visible, the movements of respiration are separated by long intervals, or no attempts are made unless some strong reflex irritation is applied. In the deeper stages of asphyxia the face and lips are pallid, the extremities blue, the muscles of the limbs and neck have lost their tone, no attempts are made at respiratory movements, or only a few inspiratory efforts accompanied by indrawing of the ribs and epigastrium, but without any effect in expanding the lungs.

(b) *Asphyxia* may be due to causes which operate after birth. In rare cases a hæmorrhage has taken place during birth into the 4th ventricle (Harrocks), or into the substance of the medulla, and thus the respiratory centres are paralysed. In others, meconium liquor amnii has been sucked into the air passages during the act of birth, or a hæmorrhage may have taken place into the lungs through pressure during birth (Spencer). Among the rare causes, asphyxia may be due to an imperfect development of the diaphragm, double pleuritic effusion, syphilitic infiltration of the lungs, and pressure on the trachea from enlarged glands. The commonest cause, however, is weakness or immaturity on the part of the infant, its ribs being wanting in rigidity and its inspiratory forces feeble, so that it fails to draw in air with sufficient power to inflate the lungs, and the latter remain to the greater part of their extent in the fatal or unexpanded state, a condition to which the term of '*atelectasis*' is applied. These infants who have some complete physical obstruction to the entrance of air into the lungs necessarily only survive their birth a few minutes; either no attempt at respiration is made or inspiratory efforts are accompanied by recession of the chest walls, without any air entering the chest. Premature or weakly infants may survive for many hours or even days with a large portion of their lungs in an unexpanded state. They are extremely feeble, their cry is weak and whispering, their lips and limbs are dusky blue, and their temperature below normal. Their respiratory movements are confined to slight contractions of the diaphragm, sometimes accompanied by indrawing of the walls of the chest; they have hardly strength to suck, and are in a stony or semi-comatose condition. They frequently suffer from local twitches, less often general convulsions. If they live over forty-eight hours they become jaundiced and the limbs redematous. An examination of the bodies of such infants reveals the usual signs of death from asphyxia: the blood is dark and fixed; the right heart and veins distended; the sinuses and membranes of the brain congested, and a meningeal hæmorrhage may be present. The lungs will be found in a condition of *atelectasis* or pulmonary apoplexy. In a case which we recently examined in which the infant died six hours after birth, both lungs sank in water, were solid everywhere except at the anterior edges, where there were clusters of air-containing lobules and also similar expanded

vesicles of a light red colour, scattered over the surfaces of the upper lobes. The cut sections displayed purple solid lung without a trace of expanded bubbles, a condition due probably to a pulmonary apoplexy occurring during birth. In another case, where the infant lived three days, the lungs and heart together just floated in water, but the lungs everywhere had a solid feel, crepitating very slightly; the surfaces of both lungs were covered with distended bubbles, while the central parts were solid. As a rule, the upper lobes are most often expanded than the bases, and the anterior and inferior edges and surfaces more than the central parts. Care must be taken not to confound atelectasis of the lung with pneumonic consolidation; the latter condition is rare in the newly born.

Treatment.—1. Remove any mucus or fluid from the fauces and air-passages by means of the finger or by suction with a soft india-rubber catheter. Inverting the body may be useful.

2. Attempt to excite respiration by some form of irritation applied to the skin. Fanning the face or directing a current of air by means of a pair of bellows is often of use. This may also be effectually done by placing the infant in warm water (100° F.), and then dashing cold water over it by means of a sponge or the hand, or by slapping it with the wetted corner of a towel, or, if the Faradic current is at hand, a feeble current may be applied to the diaphragm and other respiratory muscles.

3. If these methods fail, no time should be lost in directly inflating the lungs by a soft catheter passed into the larynx, or by Richardson's bellows, or by practising artificial respiration by Sylvester's or Schuller's method, which is to be continued as long as the cardiac sounds can be heard.

Active treatment will less often be required in those cases of aphylia supervening after birth from non-expansion of the lungs. Gentle measures may be undertaken to excite more active respiratory effects, and to combat the somnolence by means of hot and cold water, or by the application from time to time of stimulating liniments to the chest. Such infants, however, but feebly respond to our efforts, and over-treatment in this direction may easily do more harm than good; our efforts will mainly have to be directed to placing the infant under the most favourable conditions for gaining strength and gradually bringing about expansion of the lungs. One of the most important indications is to maintain its heat. As soon as possible it should be surrounded by cotton wool and placed before the fire; if too feeble to take the breast, milk should be drawn from the breast and given the infant by a spoon or small feeding bottle. It may even be necessary to feed it by passing a No. 12 or No. 14 soft india-rubber catheter (Jacquet's patent) into the stomach, and thus introducing, by means of a syringe or funnel, half an ounce of milk; the catheter must be quickly withdrawn to prevent reflex of the fluid. In the care and nurture of these weakly infants various means have been adopted; for instance, placing them in cradles or cots in small chambers where the temperature is maintained by artificial means. The best known of these is the 'Conveuse' of Armand, which consists of a box, in which the basket containing the infant is placed, and maintained at a temperature of 100° Fahr. by means of a reservoir of warm water heated by a special arrangement; a glass lid covers in the box, and ventilation is secured by a current of air which has passed over the warm water reservoir.

Apoplexia Neonatorum.—Cerebral hæmorrhage occurring in early life is hardly ever the result of a ruptured artery, but is almost invariably caused by a venous congestion, and takes place from the capillary vessels of the pia mater or choroid plexuses. The arteries of the young are not liable to suffer from aneurisms, but retain their elasticity, and, moreover, are not likely to have to sustain in any unusual strain from an hypertrophied heart. On the other hand, the pia mater in early infancy is exceedingly delicate, and its capillaries fragile, as can be readily demonstrated by noticing how easily it is stripped from the brain by means of dissecting forceps, and how loose is its connection with the soft brain substance beneath it. Further, we have already alluded to the fact that the cerebral sinuses and veins become distended with blood in apoplexy from various causes—a rupture of the capillary vessels of the



FIG. 4.—Meningeal Hemorrhage in an Infant; death on the twenty-second day.
(After M. Post.)

pia mater takes place, and blood is effused into the sub-arachnoid space. This effusion, in consequence of the loose connection of the pia with the brain, may extend over a large surface, or burst into the sub-dural space. The blood clot may compress or lacerate the brain substance, and if the infant lives for a few days it may be followed by softening. The hæmorrhage may take place during birth, from compression of the umbilical cord, producing asphyxia, and is consequently especially common in breech presentations; or it may result from pressure on the head by the uterus or the blades of the forceps (Spencer). We must bear in mind that the pia mater is not only very delicate and its capillaries easily ruptured if they are over-distended, but also that a stasis is very apt to occur in the superficial veins on account of their peculiar connections. Gowers has laid stress on the fact that here ascending arteries pass into ascending veins, and, moreover, these surface

veins empty themselves into the superior longitudinal sinus in a forward direction and consequently against the blood current. Thus the Sylvian vein communicates in the course of that name and courses upwards to empty itself into the superior longitudinal sinus, receiving the small veins from the motor area *en route*. Near its commencement the Sylvian vein has communications with the superior petrosal sinus (Testa) and also with the basilar vein.

Spencer¹ comes to the conclusion, as the result of an examination of the bodies of 130 infants born dead or dying soon after birth, that pressure on the skull by the forceps or the uterine walls plays an important part in producing meningeal hæmorrhage. He believes that when the bones of the skull are abnormally soft and the suture lax, the lower edge of the parietal bone may press on the Sylvian vein or its connections, when the head is subjected to severe pressure during labour, and thus a hæmorrhage in the Rolandic area may be produced (fig. 45). He also thinks that clamping of the internal jugular by the forceps or pressure on the infant's neck by the parturient canal may give rise to congestion and meningeal hæmorrhage. It would appear from the observations of Spencer, that, while these cerebral hæmorrhages are most common in severe and instrumental labours, they are not unknown in labours that are short and easy. The infant may live some days after the hæmorrhage has taken place, as is a case recorded by McNutt; the labour, which was a breech presentation, was easy; the breathing became irregular on the day of birth; later it suffered from convulsions, difficulty of swallowing, left hemiplegia, and emaciation. It died on the twenty-second day. At the *post-mortem* the right hemisphere was covered by a clot (see fig. 45), which was firm and gelatinous, and of a dark colour, the convolutions beneath it were in part destroyed, especially so in the ascending frontal and parietal regions. The clot also invaded the brain substance, actually forming part of the roof of the ventricle, whilst the site of the corpus striatum and optic thalamus was occupied by a reddish-brown clot mixed with softened brain tissue. This case is remarkable as showing how long an infant may survive an extensive cerebral hæmorrhage and the further damage by the secondary inflammatory softening which evidently took place.

These are instances of fatal cases, but there is good reason to believe that such cases frequently survive, and bear for the rest of their lives traces of the damage done to their brains at birth. It is not difficult to imagine the damage which a surface hæmorrhage may do. It may lead to compression of the convolutions, or meningitis, or softening, or it may more likely lead to atrophy, or interference with the development of the convolutions. Such a case, verified by *post-mortem*, has been recorded by McNutt. The infant was born with the feet presenting, the labour was tedious, and there was delay in disengagement of the head. Convulsions supervened, lasting for some days; the child never walked or spoke; there was spastic paralysis of both sides, except the face; it died at two and a half years. Atrophy of the convolutions about the fissure of Rolando was found at the *post-mortem*. Similar cases are tolerably common; there is a history of a difficult labour; the infant is blue, and perhaps is thought by the midwife to be dead; it may be convulsed, but recovers. There is probably no marked paralysis at first,

¹ *Obstetrical Transactions*, vol. xviii.

to the sutures. The scalp is not discoloured. The tumour varies in size from a walnut to a small orange, increases in bulk for a few days after birth, and then begins slowly to diminish. After it has existed for a week or two, a ridge of bone may generally be felt at its circumference, where the bone has been thrown out by the periosteum (see fig. 6, c). When the tumour is examined for the first time in this stage, it is apt to give the impression that there is a circular defect in the parietal bone, through which a firm tumour is protruding. At times, especially in chronic cases, this plate of bone from here and there in the periosteum forming the roof of the tumour and gives rise to a feeling of crepitation when it is handled. In the course of a few weeks or a month the tumour shrinks and disappears, leaving for perhaps many months a more or less complete bony ridge, which marked the circumference of the tumour. The etiology of these blood-swellings is not very clear, but, like other hemorrhages which take place during birth, they owe their production in part to asphyxia, in which there is increased tension in the cranial veins, and a condition of blood which readily allows of extravasation. From the fact that the tumour mostly occurs at the site of the *caput succedaneum*, being over the right parietal bone in nearly three-fourths of the cases, it would appear that pressure upon the head played an



Fig. 1.—Double Cephaloematomata in an infant twenty days old (from a photograph). Sutures visible, incision marked; right facial paralysis.



Fig. 2.—Section of a Cephaloematomata (from a photograph). a, Dura mater; b, parietal bone; c, periosteum; d, thickness of skull; e, scalp; f, blood clot.

important part in its causation; but, on the other hand, cases are reported in which a blood-swelling appeared over a parietal bone in a case of breech presentation (Kunze, McNatt). Small extravasations, the size of a pea or a shilling, may frequently be seen beneath the periosteum in making *perimetria* on newly born infants. If the *caput succedaneum* be incised, the tissues immediately beneath the scalp will be found infiltrated with a jelly-like effusion, with numerous minute hemorrhages scattered through it, and

on examining the parietal bone numerous small haemorrhages may be seen beneath the pericranium, some linear in shape, corresponding with the lines or foramina in the bone situated near the interparietal suture or posterior fontanelle. According to Férri the edges of the foramina play an important part in wounding the vessels during labour, and producing a haemorrhage, as they are the means of transmitting small veins from the scalp to the cerebral sinuses. It is important to bear in mind that not infrequently an effusion of blood external to the skull communicates with an effusion of blood between the bone and dura mater through one of these openings, and, further, a meningeal haemorrhage may also take place.

Three *post-mortem* examinations made by Ruge are worth recording, as illustrating some of these points: (1) breech presentation; delay in delivering head; infant born in condition of asphyxia; died on the eighth day in convulsions. The *post-mortem* showed a cephalhaematoma over the left parietal bone surrounded by a bony ridge; a large haemorrhage over the convexity of the brain beneath the dura mater, reaching to the base and upper part of the cervical cord. (2) A premature infant delivered by forceps in consequence of maternal eclampsia, born asphyxiated, died on the first day; there was a cephalhaematoma over the right parietal bone, communicating through a fracture in the bone with a second effusion of blood beneath the bone between it and the dura mater. There was also meningeal haemorrhage. (3) Infant born asphyxiated, convulsions, death on the sixteenth day from arteritis umbilicalis. There was a cephalhaematoma, covering the whole of the right parietal bone; a hard bony wall needed in the circumference of the swelling. A surface haemorrhage had taken place at the base of the brain.

The diagnosis is not generally a matter of difficulty. A blood tumour beneath the pericranium is distinguished from a caput succedaneum, inasmuch as the latter does not fluctuate, disappears in a day or two, and extends beyond the limits of a parietal bone. It is distinguished from a meningocoele in that the latter corresponds to a suture or fontanelle, pulsates, and increases in size when the infant cries. Very rarely a blood swelling takes place beneath the scalp, between the latter and the pericranium. In such cases the scalp is discoloured, no bony ring would be formed, and the swelling might extend beyond the suture. The prognosis as far as a cephalhaematoma is concerned is favourable, but inasmuch as it is possible that it is complicated by meningeal or extradural haemorrhage the prognosis must be guarded, and any brain symptoms are necessarily of evil omen.

Treatment.—The treatment of these blood swellings has been much discussed. On the one hand, it has been urged that if the cephalhaematoma is subperiosteal, it should be aspirated without delay while the blood is fluid and before coagulation has taken place, as in that way the long delay during which absorption and deposition of bone are taking place is avoided. On the other hand, it has been pointed out that it is never possible to tell if the blood swelling does not communicate with a blood extravasation within the skull, thus rendering surgical interference risky, and moreover that, although absorption of the effused material may be rapid, it is both safe and sure, and a good result may be confidently looked forward to. The latter course is certainly to be recommended; surgical interference in a newly-born infant always has its risk, there is always the possibility of introducing

septic organisms into the blood swelling by aspiration, and at the most all that is to be gained by such a proceeding is the saving of a few weeks of time. We believe that all cephalo-haematoma are most safely let alone, care being taken to protect them from injury: small ones may be shaved and painted with collodion, or during sleep some spirit lotion may be kept applied. In the rare event of their suppurating the treatment would be that of an ordinary abscess—viz. evacuation of the pus and drainage.

Haematoma of the Sterno-mastoid.—If an attempt be made by an undelivered midwife to disengage the after-coming head by pulling on the legs or body of the infant, there is a strong probability that injury will be done to the neck or other part, especially as the muscles of the semi-asphyxiated infant are flabby and torpid, and the blood readily oozes out of the vessels. Such an injury does at times take place, giving rise to a blood tumour within the sheath of one of the sterno-mastoids in consequence of the tearing through of some of the fibres of the muscle or injury to some of its vessels. It is not often that an opportunity occurs of verifying this condition *post mortem*, inasmuch as no serious consequences arise from the accident, but the investigations of Tordens, Spencer, and others make it clear that these swellings are due to local haemorrhage resulting from injuries at birth. In one of our own cases in which the infant died of diarrhoea when six months old, a cicatrization of the muscle at the spot where the injury had taken place was found. In another case we had also the opportunity of a *post-mortem*. At least three-fourths of these cases are breech presentations; in the remaining fourth, which occur in head presentations, the injury is no doubt caused by dragging on the head in order to disengage the shoulders and body. The swelling in the neck may be noticed by the mother a few days after birth, or it may escape observation for some weeks, or even more. On examination a tumour about the size of a pigeon's egg may be felt in the upper part of the right sterno-mastoid; it is generally irregular, or perhaps elongated, in shape, and if not seen for some time after birth, when cicatrization has taken place, it is hard and cartilaginous to the touch. The left muscle is less often injured than the right; sometimes the whole length of the muscle is affected, though the lesion is generally in the upper part. The tumour disappears in the course of a few months, but for a long time a cicatrix may be felt. There is no treatment required. These cases mostly occur among the poorer classes, who are attended in their confinements by neighbours or unskilled midwives. Injury to the sterno-mastoid during birth derives its importance from the fact that such injury is likely to be the cause of wry neck in after life (see TORTICOLLIS).¹

Occipital Haematoma.—Injury to other muscles may occur during birth, and we have seen in one case a 'tumour' in connection with the muscles at the back of the neck arising from injury during birth. It was a head presentation and there was also a sterno-mastoid 'tumour.' The child was seen at five weeks old. Labour had been prolonged, head delivered by forceps with much difficulty, and subsequently severe traction was needed to extract the body. Two symmetrical swellings were felt in the muscles at the back of the neck, evidently due to haematoma. There was left facial paralysis and

¹ See also Dr Amy Brown, *Med. Chir. Trans.* vol. xviii. who gives a list of cases from Clutton and others' observations as well as her own.

paralysis of the left arm. The child was born of two years later, and it was said to have completely recovered.

Obstetrical Paralysis.—In cases of delayed labor, where the forceps have to be applied, or where force is used to disengage an arm or traction is applied to it, some nerves or strands of nerves are apt to be injured either by stretching, direct pressure, or compression by extravasated blood. The most common and best known is an injury to one of the facial nerves through pressure exerted by one of the blades of the forceps during extraction. A facial paralysis is thus produced, which as a rule is temporary, and disappears in a few days or weeks. The other and less common form, which has been described by Dubreuil as *obstetrical paralysis*, is due to an injury to one or other of the cords of the brachial plexus, produced by the pressure of the finger hooked in the axilla in order to retract the arm and shoulders, or the arm has been forcibly stretched when it has been used in lay hold of to drag the infant through the pelvis. Occasionally an injury may be done to the brachial plexus as well as to the facial by the grip of the forceps blades, as in a case recorded by Roger, where the face and arm were paralyzed. After death an effusion of blood was found at the stylo-mastoid foramen, and also round the cord of the brachial plexus. The cord most often injured is apparently the fifth cervical nerve, which, as Ross has shown, is readily injured, at the point where it descends over the transverse processes of the fifth and sixth cervical vertebra on its way to join the brachial plexus, by force applied to the arm or clavicle. The prognosis in paralysis of the arm from a lesion of the brachial plexus is more serious than it is in paralysis of the face, but it will necessarily vary according to the amount of injury done and the degree of paralysis present. The symptoms presented by this form of paralysis may be illustrated by the following cases which came under our notice:

In the first case, the head, according to the mother, was born first; there was then a delay; finally the left arm was disengaged by the finger hooked in the axilla, and the child born after some delay and difficulty. The infant was first seen when seven weeks old. At this time its arm hung uselessly by its side, the elbow extended, the humerus rotated upwards and abducted, the forearm pronated, the hand closed, the paralyzed muscles being the biceps and brachialis anticus, the index-quinatus and teres minor, the deltoid and supinator. The muscles affected were soft and flabby. The arm was regularly galvanised, the Faradic current being used. Three years afterwards great improvement had taken place; the elbow could be flexed and the hand could be used, but a palsy remained of the deltoid and supinator. In another case, seen first at ten weeks of age, the same muscles were paralyzed, much improvement took place, but the infant died at six months old of bronchitis. In a third case, which was a footling, the left arm engaged the pelvis with the head, and had to be brought down by the accoucheur. The arm was noticed to be bruised and useless after birth. Unfortunately this case was lost sight of. In another case seen by us, both arms were almost completely paralyzed, only the fingers in our hand retaining some power of flexion. The mother had a contracted pelvis, the head presented, the medical man arrived and delivered with much difficulty; there was also a sternomastoid tumour. In two cases reported—one by Seeligsviller, the other by Thorburn—the paralysis was more extensive than in the above cases;

there was also rent or laceration of the eyeball and contraction of the pupil of the same side. Probably there was here a more severe injury, involving the whole brachial plexus and also the sympathetic. In some cases a temporary anæsthesia has been noticed. In the treatment of these cases it must be borne in mind that one or more of the cords of the brachial plexus has been injured, accompanied by a local hæmorrhage; and therefore, the arm at first the arm can be kept for the first few weeks the better. It seems doubtful if any sharpening or galvanising of the muscles can at first do much good. The treatment must be similar that of a fractured bone—rest at first, and afterwards more or less active movement to exercise the muscles and prevent stiffness. The arm should be carefully wrapped upon cotton wool, flannel and supported by being fixed to the side, care being taken to prevent undue disturbance during the daily bath, or allowing it to hang down and drag on its connections with the trunk. It must be borne in mind that the circulation of blood will be sluggish, and easily obstructed by tight bandaging. At the end of three weeks, when there is reason to believe that absorption of the effused blood has taken place, movements of the arm may be begun, in order to give the muscles some exercise and to call forth the voluntary efforts of the child. Galvanism, sharpening the muscles, applying stimulant applications to the skin, must be persevered with as long as any improvement takes place. The prognosis in the severe cases is gloomy as far as the paralysed muscles are concerned, the arm remains in a condition of extension and pronation, and is unable to be raised to the mouth. In other cases, as in the one mentioned, recovery takes place sufficiently to allow of flexion of the elbow, though a certain amount of weakness may be left about the shoulder and in the separators of the wrist. In the slighter cases considerable improvement may be expected in the course of months or years.

Icterus Neonatorum. Infants often suffer from a more or less pronounced jaundice which comes on a day or two after birth. It has been estimated by Continental writers that this occurs in from 60 to 80 per cent. of the total births; but these observations have been usually made in lying-in hospitals, where it appears to occur much oftener than in private practice, though there is little doubt that on account of the slightness of the yellow coloration of the skin, and the frequent absence of discoloration of the sclerotic, it may easily be overlooked. Jaundice may arise from or be symptomatic of various pathological conditions, the principal during the first week of life being the following:—*1.* The common form in which no disease is apparent—*icterus neonatorum*. *2.* Jaundice accompanying a condition of septicæmia or pyæmia; is acute fatty degeneration of the newly born; is Wischel's disease. *3.* Jaundice due to congenital stricture, or dilatation of the common or hepatic duct, or to syphilitic perlepatitis. The common form to which the name of '*icterus neonatorum*' is generally applied differs from the other forms in not being accompanied by any serious symptoms, and in passing off in a few days or a week. In these cases the yellow coloration of the skin makes its appearance on the second day, less often the third, rarely either before the second or after the third, and lasts, according to its intensity, from two or three days to a week. The yellowness is first noted on the face, around the mouth and chest, then on the abdomen, later on the limbs; it may be easily overlooked, unless pressure is made by

the finger on the skin. In mild cases the sclerotics remain unaffected, and the urine does not stain the linen: this is the more noteworthy, as in the jaundice of adults the sclerotics are affected before the skin is tinged, and pigment is very early present in the urine: probably the vascularity and transparency of the infant's skin account for the difference. When the jaundice in the infant is more intense, the sclerotics become tinged: the urine stains the diapers, and bile-pigment may be detected. The stools are unchanged and contain the usual quantity of bile. In cases which die when suffering from this form of jaundice, the internal organs are found stained yellow, especially the cartilages, the brain, and in a lesser degree the abdominal viscera. The majority of infants who are jaundiced appear in perfect health: it has, however, been asserted by Hoffbauer that infants with icterus do not flourish as well as other infants, that their loss of weight during the first week is greater than that of healthy infants, and that a higher percentage of urea and uric acid appears in the urine. The cause of this form of jaundice is uncertain: it is much more frequent in lying-in hospitals than in private practice, and in premature weakly infants with partially expanded lungs than in full-time and healthy infants. There have been many hypotheses concerning its cause, but none of them are entirely satisfactory. One of the most plausible explanations has been suggested by Quincke: he attributes the jaundice to the ductus venosus remaining patent, thus allowing some of the portal blood (which contains bile-pigment) to pass into the general circulation, instead of all of it being consumed in the action of the liver. Virchow and others believe it to be a hemutogenous jaundice, the bile-pigment originating in a destruction of blood corpuscles which it is supposed takes place shortly after birth.

While this form of jaundice is for *us* a symptom of little importance, and in the vast majority of cases the infants do well, it is well to remember that occasionally cases occur which are jaundiced shortly after birth, and which die about the ninth or tenth day without any definite disease being discoverable. These cases sometimes occur in the same family, as in the following remarkable instance: the father and mother were both healthy and in comfortable circumstances, there was no history of syphilis, the first and second children were never jaundiced, and are at present alive and well; the third, fourth, fifth, and sixth children became jaundiced on the second or third day, and died on the ninth or eleventh day. In all, the skin and conjunctive were jaundiced, the urine contained bile-pigment, the stools were normal. The fifth child was seen with Mr. G. H. Fiedor, their medical attendant, when five days old: it seemed a perfectly healthy infant, except that it was jaundiced. The infant became weaker and drowsy, and died comatose on the sixth day. A partial *Autopsies* only was obtained: the abdominal viscera were bile-stained; the ductus venosus was only partially closed: there was nothing abnormal about the bile-ducts. What is the nature of these and similar cases it is at present impossible to say. The diagnosis between icterus neonatorum and the jaundice which accompanies septicaemia does not present much difficulty, for in the latter case there would be some suggestion of phlebitis of the umbilical cord or ecchymosis and various hemorrhages. In acute fatty degeneration and Winkler's disease there are mostly cyanosis, purpuric spots, and hemorrhages. In jaundice from obstruction of

the ducts, the jaundice is intense and bile is absent from the stools. Nothing much can be said about the treatment of infantile jaundice, which consists rather in attending carefully to the general health of the infant than in the administration of any special drug. Small doses of *iod. c. cret.* may be given for its laxative effect, and to relieve any tendency to mechanical congestion of the liver.

Hæmorrhagic Diathesis. Hæmophilus Neonatorum.—It not infrequently happens that within a few days of birth the infant exhibits a tendency to bleed. There may be hæmorrhages from the nose, stomach, bowels, or kidneys, and petechiæ and ecchymoses may make their appearance on the skin. Thromb of blood, which is perhaps difficult to arrest, may take place from the navel on the separation of the cord. This tendency to bleed is no doubt to be looked upon as rather a symptom than a disease or the result of disease. It cannot be said that our knowledge is very exact regarding the conditions which give rise to the hæmorrhagic diathesis in infants, but in a large majority of cases at least the infant is either syphilitic or suffers from septicæmia or from both conditions. The poisons generated by the syphilitic or septic infection appear to cause such changes in the blood as give rise to bleeding on the slightest injury. In some of the cases in which there was no evidence of syphilis during life, the evidence has been forthcoming at the post-mortem, and, moreover, syphilis is not disproved by its lesions being discovered in an infant a few days old.

In seven cases recorded by Fuschl¹ in which hæmorrhages took place shortly after birth from the mucous membranes or upon the skin, there was evidence of syphilis; there being characteristic rashes on the skin, enlargement of the spleen, and interstitial hepatitis. In one of the author's cases, however, the only evidence of syphilis was the enlargement of the spleen and an interstitial hepatitis. A careful microscopical examination of the minute blood-vessels was made in these cases, with the result that they were found normal, so that the bleeding could not be attributed to arteritis.

In those cases of hæmophilia in infants recently investigated by H. Neumann,² pyogenic organisms were found, and the author inclines to the belief that the entrance of the septic organisms into the system either before or during the act of birth had much to do with the hæmorrhagic state. In the first case the infant, which was illegitimate, suffered from jaundice, petechiæ on the skin, melæna, and hæmatemesis; it died on the fifteenth day. The autopsy showed there had been capillary bleeding from the mucous membrane of the alimentary canal, enlargement of the spleen, and interstitial hepatitis (syphilitic). A bacteriological examination of the blood showed the presence of the *Bacillus pyocyaneus*. In a second case, undoubtedly syphilitic (snuffles and rash), which suffered from bleeding from the nose and mouth, and which died when seven weeks old, a bacteriological examination showed the presence of pus cocci, namely, *Staphylococcus pyogenus aureus* and *albus* and also *Streptococcus pyogenes*. In a third case, in which the mother suffered from syphilitic ulceration of the labia, the infant suffered from jaundice and various hæmorrhages, and died on the ninth day. Both bacilli and cocci (*Bacillus pyocyaneus* and *Staphyloc. pyog. aureus*) were

¹ *Archiv für Kinderheilk.* Band viii.

² *Ibid.* Band xii. etc.

found in the blood. It is not easy to say in the present state of our knowledge whether the bacilli and cocci found were accidentally present, or whether they were directly or indirectly the cause of the blood change which gave rise to the blood extravasations. The bacilli may enter the fetal tissues before birth through the placental circulation or be inoculated at the time of birth or afterwards through the navel.

Acute Fatty Degeneration of the Newly Born.—Hahl, in 1861, described the symptoms and method anatomy of a rare disease, occurring in newly born infants, to which he gave the name of acute fatty degeneration. His observations have since been confirmed by Hecker, Finsterburg, Reiff, and Raabe, though it cannot be said that this condition is sufficiently well known for it to take its place as a well-defined and definite disease. The infants suffering from it are generally born in a condition of asphyxia without obvious cause, and some die asphyxiated. If they survive, they usually suffer from more or less cyanosis, with hæmorrhage from the bowels, stomach, or from the navel on the separation of the cord. There is often jaundice, and blood extravasations take place beneath the skin, conjunctiva, or mucous membrane of the mouth; there may be general oedema; death usually takes place within two weeks. At the *post-mortem* minute hæmorrhages are found in the various internal organs, which are sometimes infiltrated with blood; the tissues are discoloured. On microscopical examination of the tissues of the heart, liver, kidneys &c. they are found to be in a condition of fatty degeneration. The nature of the disease is quite unknown. It is interesting to note that a similar condition has been observed in newly born pigs and other domesticated animals.

Winkel's Disease.—A disease somewhat similar to the last has been described as occurring in an epidemic form by Winkel, and is characterised by cyanosis, jaundice and hæmoglobinuria. This epidemic occurred in the Foundling Hospital at Dresden in 1875, where twenty-three infants were affected in the course of a month. The symptoms noted were first of all a bluish tinge on the skin of the face, body, and limbs, with a more or less toxic tint; in some cases there were vomiting and diarrhoea. The urine was of a light brown colour, with a sediment consisting of epithelium and casts; the blood contained an excess of white corpuscles and many granular bodies. The symptoms usually began on the fourth day after birth, death occurring in one case in nine hours, though the average duration of the disease was about two days. The sections showed a yellow staining of the skin and internal organs. The spleen was large and hard and dark red; the kidneys were usually dark brown in colour, the microscopic examination showing their tubules to be filled with granular pigment. There were punctiform hæmorrhages on the surface of the various internal organs, and fatty degeneration of the liver and heart.

Gastro-intestinal Hæmorrhage.—The vomiting of blood, or its passage per anum, is not an uncommon occurrence in the newly born. The most common cause, especially of hæmatemesis, is the swallowing of blood coming from a cracked nipple, which the infant sucks, or from some wound in the infant's mouth or nose. Large quantities of blood may be swallowed in this way, and vomited in a more or less altered condition, or passed as blackish masses with the faeces. A hæmorrhage may have taken place into the

bowel during labour and the blood passed in the stools. A much more serious condition exists when the source of the bleeding is a small ulcer or ulcers in the stomach or duodenum, which may open a large vessel and cause fatal hæmorrhage, as in a case recorded by Goodhart and another by Sawdell. Neumann has recorded a somewhat similar case in an infant born of healthy parents, which died on the third day from birth after vomiting blood. At the *post-mortem* an ulcer was found in the duodenum. In the majority of cases the bleeding appears to be capillary, due to a tendency to hæmophilia, which has been described (p. 27). The hæmorrhage in most instances comes on within the first twenty-four hours; if the amount of blood lost is large, the infant quickly becomes pallid, the skin cold, the fontanelles depressed, and convulsions probably follow. Death usually takes place within twenty-four hours of the commencement of the symptoms; if the infant survives this period and no fresh attack comes on, there is reason to believe there is no lesion of the stomach or duodenum, and there is good hope that the infant may survive. The treatment would naturally depend upon the diagnosis as to the cause. Small doses of ergotine (quarter grain to half grain), in syrup, by the mouth or subcutaneously, would be the most likely to be of service. In any case of passage of blood per rectum in an infant, the possibility of an incagination of the intestine must be borne in mind.

Hæmorrhage from the Genital Organs.—It sometimes happens that there is a small oozing of blood from the vagina during the first few days succeeding birth, sufficient to stain the napkins. The blood may often be seen oozing from the vagina, while no lesion of any kind can be detected. The discharge lasts for a few days only, generally from two to five, the health of the infant does not suffer, and recovery seems always to take place. Calingworth has collected thirty-two such cases, two of which came under his own observation. He agrees with Cameron in believing that the bleeding is due to a congestion of the pelvic veins, the result of the cessation of the circulation in the umbilical arteries when the cord is tied. Accidentally stated, there is sometimes a coincident discharge of blood from the rectum, due apparently to the same cause (see also p. 20). It must not be forgotten that cases of precocious menstruation may occur, commencing shortly after birth, and continuing monthly afterwards.

Diseases of the Navel. Separation of the Cord.—Under ordinary circumstances the umbilical cord shrivels up and drops off at a period after birth varying from the first to the fifth day, this small cord drying up and separating earlier than large soft cords (blooded); the navel is not usually dry and firm until the tenth or twelfth day.

Umbilical Polypus.—Occasionally, after the cord has separated, a small red prominent projection is left with a moist surface, and sometimes (Holtz) a free central canal; this 'polypus' is the result in most cases of incomplete withering of the cord, at other times the outgrowth is rather of the nature of a simple granular polypus from irritation, the so-called 'fungus of the navel'. The projection, when small, is often hidden by the overhanging skin of the part, and may remain for weeks or months, giving rise to slight discharge from the seat and perhaps coloration of the skin around. In another class of cases such as one sent to us by Dr. Stern, of Eades, the

proximal part of the cord instead of above (fig. 6) remained as a red vascular projection some three inches long. On examining this child some five or six weeks after birth, there was a red fleshy prominence then about 1½ inch long projecting from the navel; it was about as thick as a cedar pencil, and its surface appeared to be a mucous membrane except at one spot where a patch of delicate cuticle was found. The apex of the protrusion was perforated by an orifice which readily admitted an ordinary probe, and the instrument could be passed downwards in the middle line and swept round on each side for some three inches; it could only be passed upwards for about half an inch. A thin watery mucus in small quantities was discharged, but no feces or urine. Subsequently fecal matter escaped from the orifice. The protruded mass was ligatured and removed with a good result. This condition is due no doubt to persistence of the vitelline duct in the proximal part of the cord and its conversion into intestine; it occasionally unites with the duct by means of Meckel's diverticulum. After the distal part of the cord has become detached the cord cicatrises, and a prolapse takes place of the whole thickness of the tube; hence in the section in fig. 7 two layers of mucous membrane with an intervening muscular and fibro-cellular layer are seen. Such cases are not rare; we



Fig. 7. Section of the umbilical diverticulum. *a*, central canal, continuous with Meckel's diverticulum lined with villi; *b*, *c*, remainder of villi of the proximal portion of mucous membrane; *d*, muscular glands; *e*, remains of vitelline duct; *f*, section of blood-vessel; *g*, *h*, *i*, *j*, *k*, *l*, *m*, *n*, *o*, *p*, *q*, *r*, *s*, *t*, *u*, *v*, *w*, *x*, *y*, *z*, *aa*, *bb*, *cc*, *dd*, *ee*, *ff*, *gg*, *hh*, *ii*, *jj*, *kk*, *ll*, *mm*, *nn*, *oo*, *pp*, *qq*, *rr*, *ss*, *tt*, *uu*, *vv*, *ww*, *xx*, *yy*, *zz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rrr*, *sss*, *ttt*, *uuu*, *vvv*, *www*, *xxx*, *yyy*, *zzz*, *aaa*, *bbb*, *ccc*, *ddd*, *eee*, *fff*, *ggg*, *hhh*, *iii*, *jjj*, *kkk*, *lll*, *mmm*, *nnn*, *ooo*, *ppp*, *qqq*, *rr*

consists of film on the surface of the cord has been described as **erupsions** or **diphtheritic exudation**; in some instances it is probable that a true diphtheritic membrane is formed.

Where there is any spreading ulceration after separation of the cord, infective influences should be looked for; the mischief may spread superficially or it may tend inwards and involve the peritoneum. A mere superficial excoriation of the skin analogous to *monetigo elusoria* is often seen in older children as a result of dirt and neglect. It is readily cured by the application of bone powder.

Simple ulceration is never fatal unless it extends deeply; it should be treated, according to Range, by the application of salicylic acid and starch—1 in 5 for the milder cases, or 1 in 3 if there is any sloughing; ointments be disapproved of.

Omphalitis is a rare condition. When it ruins the navel itself and the surrounding parts are inflamed and swollen, the wound remains unhealed, and the skin around is red, shiny, tense, and painful. The disease may spread and involve nearly the whole of the abdomen either superficially or throughout the entire thickness of the abdominal wall; the infant becomes very ill, the legs are stiff and drawn up, breathing is thoracic, and small abscesses may form and burst from time to time. The disease begins in the second or third week of life and may last for some days or even weeks. The prognosis is good if the extent of mischief is small and suppuration occurs early, bad if the disease is widespread, and especially if it tends inwards towards the peritoneum; if the navel vessels are involved, general sepsis or gangrene is likely to result. The younger the child the graver is the danger.

The cause of this disease is doubtful. Probably it arises from bad management of the navel and infection. Fribe believes some cases to be syphilitic. Is it possible that some may be instances of smothering phagedæna? According to Boninat it is sometimes complicated by bleeding. Treatment consists in cleanliness and the application of salicylic acid beneath a warm wet dressing (Range). All abscesses should be opened early, and any tendency to gangrene met with stimulants and antiseptics.

Gangrene of the navel begins either as an ulcer or as omphalitis; it occurs also in cases of cholera infantum; as a purely local condition it is rare, and Wiedeböcker believes that it arises from intense omphalitis. Premature separation of the cord and irritation tend to produce gangrene.

The disease usually begins as a fissure containing malodorous fluid; on bursting this leaves an ulcer, or a sore may exist from the first; the mischief spreads rapidly either superficially or deeply; a bright red zone is seen surrounding a central slough, which after a time comes away; there is rapid prostration of strength, though but little pyrexia. Recovery from gangrene of the navel is rare, though sometimes the slough separates and the cavity granulates up; more often death results from peritonitis or exhaustion, or again from gangrene of the bowel and perforation, which is sometimes met with; occasionally a fecal fistula is formed.¹ In many cases general sepsis occurs, and Ritter believes the gangrene is merely a result of the septic condition. In cholera infantum there is sometimes rapid gangrene without any

¹ In one remarkable case an anastomosing occurred through a fecal fistula.

signs of reaction, and this may occur as late as several months after birth; it is always fatal.

The treatment of gangrene consists in free stimulation and the use of antiseptics; nitrate of silver, perchloride of iron, and salicylic acid are recommended by Range, in whose work, '*Die Krankheiten der ersten Lebensjahre*,' we are indebted for nearly all our information on these diseases. Facial fistula, if the child survives, should be treated as in older children.

Umbilical Arteritis.—In fifty-five subjects of disease of the umbilical vessels Range found fifty-five cases of arteritis, and in only one was there phlebitis alone. The mischief begins as inflammation of the cellular tissue round the vessels, and then spreads to them, producing thrombosis. Pelvic cellulitis, which sometimes occurs, is the result of septic lymphangitis spreading directly along the cellular tissue, and is not due to embolism.

Hugh Hirschfeld believed in phlebitis as a common affection, but Range points out that the greater frequency of arteritis is due to the fact that the area of cellular tissue surrounding the arteries is twice as great as that round the veins. Inflammation in cases of arteritis may spread far and wide from the navel, and even reach the bladder or its neighbourhood. Where arteritis erodes the navel presents often a projecting discoloured ulcer covered with a scab; sometimes, however, the scar is healed and quite natural in appearance. The disease may arise either before or after separation of the cord, and suppuration and sloughing may occur.

Sometimes the lumen of the arteries is soon open, and the vessels are full of pus or breaking-down clot. Suppuration usually spreads along the vessels as far as the cellulitis extends, beyond this adherent marginula are found. At times the arteries are pushed, and the sacs formed are found full of pus; the intima of the vessels is always dull and has lost its polish.

The most common complication of the disease is pneumonia; this was found in twenty-two of Range's fifty-five cases; septic inflammatory foci may, however, also occur in the liver, spleen, kidneys, peritoneum, bones, and joints, &c. Erysipelas sometimes attacks the part, and slight jaundice is common, though severe jaundice with hepatitis is rare. Of Range's fifty-five cases, in nine there was arteritis alone, in sixteen there were complications, such as syphilis, 'atrophy,' cerebral hæmorrhage, &c., and in the remaining thirty cases there were pyæmic lesions. Buhl, Wiederhofer, and Müller differ from Range in thinking that usually the disease affects only the abdomen and its viscera. Peritonitis is to be suspected as soon as distension appears. Tetanus is an subsequent complication. Arteritis is a disease of dirt and neglect; it occurs in epidemics, and is often associated with puerperal fever; it may be inoculated by the lochia or decomposing umbilical cord, and has been found associated with ophthalmia neonatorum. It usually runs a rapid course, lasting from four to eighteen days, and is especially fatal to young and premature children. In older infants the progress, though bad, is not absolutely so; in fatal cases death is usually sudden.

Umbilical Phlebitis.—As already pointed out, umbilical phlebitis is a rare disease. Hugh Hirschfeld, in examinations of sixty infants who died of septic diseases beginning in the navel, found eleven cases of phlebitis, four cases of simple thrombosis of the vein, and thirty-two cases of arteritis, while in three instances both the arteries and vein were involved. Range has only twice seen phlebitis apart from arteritis.

The general appearances of phlebitis are very like those of arteritis; there is thickening of the perivascular tissue, the lumen of the vein is diminished; it is tortuous and contains pus or various material, the intima is cloudy and eroded. Usually the whole vein as far as the liver is affected, and there may be hepatitis; Wunderhofer found Glisson's capsule and the portal vein both involved. Peritonitis and intense jaundice are both common. The etiology of the disease is the same as that of arteritis. The symptoms of phlebitis are fever, icterus, altered respiration, inspiration being short, expiration prolonged, while the breathing is shallow, frequent, and entirely thoracic; the upper part of the abdomen is tense, and there is local tenderness, the knees are drawn up, and the child is restless. It is difficult to diagnose phlebitis from arteritis; the intense icterus in the former is the most characteristic feature. The disease lasts only a few days, and is always fatal from general sepsis. The treatment of both arteritis and phlebitis consists in the application of salicylic acid or other antiseptic and the use of stimulants and food nourishment, together with careful cleanliness.

These diseases appear to be almost unknown in this country at the present day, judging from the absence of any literature, but they are likely to be met with in dirty quarters of large towns.

Umbilical Hemorrhage is to be looked upon as a symptom rather than a disease in itself; it is met with in the shape of bleeding from the umbilical vessels themselves, and as a general oozing from the raw navel surface.

Bleeding from the vessels may occur from slipping or imperfect tying of the ligature round the cord; as, for instance, when a thin ligature cuts into the vessels. Bleeding, of course, by no means necessarily follows slipping of the ligature, or even failure to tie the cord at all. The aspirating action of breathing prevents any hæmorrhage in most instances, and this is supplemented by the contraction of the vessels after birth.

Asphyxia may, however, produce some escape of blood, as the vascular pressure rises in slight degrees of suffocation; in other instances deficient muscular contraction appears to be the cause, hence bleeding is most common in premature children who have been asphyxiated or whose lungs have not expanded. If it arises from imperfect muscular contraction it may occur some hours after birth (Hofmann). As the vessels begin to contract at the cord, and the obliteration extends towards the hypogastric, there is more risk of bleeding if the cord is cut very short. So, too, drying up of the cord tends to obliterate the vessels, while gangrene and seeping tend to prevent their closure. Bleeding may also occur later from rough handling of the navel and separation of the scabs. All danger from this form of hæmorrhage may be prevented by tying the cord firmly with a broad ligature not too near the abdominal wall; should bleeding occur, pressure or the application of astringent powders, a fresh ligature or amputation will arrest it.

Idiopathic, or spontaneous bleeding, so called, is a very rare occurrence, and its etiology is obscure. Gratzdiner collected twenty-two cases from various sources. The bleeding usually occurs about the fifth day, just after or more rarely before the cord comes away; the blood trickles from the surface of the umbilicus, and not from any distinct vessel; the oozing may be continuous or intermittent. The subjects of the affection are generally

¹ It may, however, come on in the third week.—Hofmann.

healthy full-time children; there is often, however, slight icterus; in other cases there is some intestinal disturbance, vomiting, colic, &c., with deep icterus, cyanosis, and dyspnoea before the bleeding occurs; in any case these symptoms appear soon afterwards. Bleeding not seldom comes on from the stomach in infants, or there may be general purpura, and sometimes there is icterus of the hands and feet together with the umbilical hæmorrhage.

The great difficulty or impossibility of stopping the flow is characteristic of the condition. Most of the cases die before the second week; the mortality is put down as 53 per cent. The infant usually dies comatose, less often in convulsions.

Umbilical hæmorrhage is a symptom of several diseases; probably in some cases, as we have already pointed out, it is due to hæmophilia or syphilis. Prurition, drink, and other depressing causes acting upon the mother are also assigned as reasons for it. Septicæmia and 'fatty degeneration of the newly born' are causes that have been established by *post-mortem* evidence. The blood in these children does not clot readily. It is said to be a common disease in America than elsewhere.

Pressure by various means, such as pads, filling the sac with plasters of Paris, underpinning, &c., may be tried as means of treatment with some hope of success; caustics and astringents, such as perchloride of iron, do not appear to be of much use; the actual cautery has succeeded. Idiopathic bleeding is very rarely met with. Fuchs has, however, collected records of some cases;¹ it is sometimes epidemic. Weiss had 31 cases out of 742 children in one year at Prague.²

For other morbid conditions of the umbilicus, see 'Deformities of the Umbilicus.'

Tetanus Neonatorum.—This disease is almost unknown in this country at the present day, although in past times, when less attention was paid to general hygiene in lying-in hospitals, it was common, and sometimes was the largest factor in infant mortality; it was also frequent at one time among the negro population in America. The disease is identical with the wound tetanus of adults, and is caused by inoculation of the navel with the tetanic bacillus. This bacillus, as shown by Nicolaier, is constantly present in the superficial layers of the earth, and it gains entrance to the infant's body by dirty dressings applied to the navel. The bacillus multiplies in the neighbourhood of the navel, and a strychnine-like poison is absorbed, which gives rise to the muscular spasms. The bacilli may be detected in the pus of the navel wound, and if the pus be injected into mice they die with tetanic symptoms (Rosenbach, Feiper). Tetanus ('nine-day fits') usually appears in the first two weeks of life, most commonly from the third to the tenth day, the limits, according to West, being from the fifth day to the fifteenth day. The symptoms are usually acute, the earliest being inability to suck from spasm of the facial and jaw muscles (risorius); general contractions, however, soon occur, the spasms are continuous, but increase in violence at intervals; in most cases there is no complete relaxation. The

¹ *Arch. f. Kinderh.* Bonn, p. 265.

² For further details, vide a paper by Dr. Fuchs, *Mém. de l'Académie des Sciences de l'Université de Prague*, 1872.

child often utters a peculiar whining cry, and there is well-marked tonic spasticity; the maximum rigidity is generally reached in twelve hours, and the child dies in a fit or becomes comatose.

The spasms are increased by any exposure to cold and by noise; excitation is very rapid, and there is often jaundice. Death usually occurs in one or two days; in rare cases the disease is chronic. Hartigan says the chronic form begins with dysentery and coldness and pallor of the skin; hence it has been called 'white lockjaw.' It is attended by wasting and twitchings, and was described by Marion Sims as 'Trismus.' Unlike the acute form, which always occurs within the first month of life, the chronic variety may appear at any time within six months, and may be a sequel of the acute.

The disease is readily recognized by the spasms and general rigidity.

The *prophylactic treatment* consists in the most rigid cleanliness in dressing the navel and the removal of insanitary conditions. Opium, chloral, bromide of potassium, cannabis indica, belladonna, and other drugs have been occasionally successful; warm baths sometimes relieve the spasms, and spinal injections are worth a trial; anesthetics, such as ether and chloroform, are useful to relieve pain and allow the child to be fed, but none of these remedies have given any constant good result. Further details of the disease and references will be found in the works of Boechat, Moys and Pepper, Pelzer,¹ Haginsky.²

Sclerema Neonatorum.—This rare disease is practically unknown outside travelling asylums and lying-in institutions, and is by no means common under any circumstances. The chief characteristics of the disease consist in an induration of the skin and subcutaneous tissues, and marked wasting, with an abnormally low temperature. The infants at birth may present no abnormality, and in some cases at least are plump and healthy-looking; within a few days of their birth they begin to waste, the temperature becomes abnormally low, 83° to 86° F. in the rectum, and the integuments become hard and rigid; the change usually begins in the lower extremities and spreads upwards, and involves the trunk, upper extremities, and face. In typical instances the skin is of a dirty yellow colour, its surface is hard and does not pit, and it cannot be raised from the subcutaneous tissues. The surface of the body has a cold feel almost like stone. In some described cases the rigidity of skin has been so great that the infant could be lifted by the head and heels like a rigid body. On account of the rigidity of the skin of the face, suckling is performed with difficulty, and the infant has to be fed with a spoon. The prognosis is bad, as such infants almost invariably die in a few days. In a typical case investigated by Dr. W. P. Northrup, of New York, the microscopical examination of the skin showed nothing abnormal. In a case of Dr. J. W. Ballantyne's there was an increase in the number and size of the connective-tissue bundles and an atrophy of the adipose tissue. Langer attributes the rigidity of the integuments to solidification of the fatty tissues, in consequence of the abnormally low temperature. In one case, however, reported by Dr. A. G. Hays, which he believes to have been of this nature, the infant, which was a month old when seen by him, made a good recovery. In this case the skin over the buttocks and thighs was hard

¹ *Disorders Affecting the Newborn Infant*, 8th edn. (B. 1) = 2.

² *British Medical Journal* (London) (N. 5, 1914).

and rigid, and could not be raised from the deeper tissues. But it appears to have been red and shiny, and without the cold feel so typical of the ordinary cases of sclerema. The pathology of these cases is ill understood. It has been suggested with much plausibility that they are akin to myxodema. We have seen a similar case in a girl two weeks old, in which the tissues of the back of the trunk, arms and legs were much indurated, red and shiny. They were too hard to pit with the finger. We think that this case, as also Dr. Burns', were not identical in nature with those described as sclerema. We unfortunately lost sight of our case; the infant was apparently healthy and thriving.

Edema Neonatorum. Weakly, especially premature, infants are apt to be oedematous at birth, or become so soon after. An oedematous condition of the skin and subcutaneous tissues differs from sclerema in that the former readily pits beneath the finger, and the skin is more or less smooth and shiny. It is obvious that oedema may be present in many different conditions, and it does not in itself constitute a disease.

Gonorrheal Ophthalmia.—Though hardly within the scope of this work, mention might perhaps be made of the danger to the infant of infection by gonorrheal discharges from its mother at birth or shortly after. The most common affection is that of the eyes, in which a virulent purulent ophthalmia is produced. The inflammation rapidly spreads to the eyelids, and involves the cornea, speedily causing opacity, and if allowed to run its course unchecked ending in perforation of the cornea, with escape of the contents of the globe and complete shrinking of the eyeball. Many cases of total blindness in children are due to this cause. In any case where there is a suspicion of vaginal discharge from the mother, an antiseptic douche should be carefully used before the birth of the child, and immediately after it is born the child's eyes should be examined and carefully washed out with a solution of perchloride of mercury (1:4000), followed by a douche of boric acid lotion. At the least sign of any inflammation the eyes should be washed with a solution of sulphate of zinc (2 grains- $\frac{1}{2}$), and unless the discharge is at once checked a solution of nitrate of silver (10 grains- $\frac{1}{2}$) should be employed once a day, washing out again with a solution of salt directly after to prevent too powerful action of the silver. The eyes should be bathed every hour day and night with a lotion of boric acid, and the silver repeated if necessary. It is only by such means that the eyes can be saved in severe cases. The utmost care must of course be taken to use all applications thoroughly and get rid of every particle of discharge, as well as to avoid subsequent re-infection. For infantile gonorrheal rheumatism, *vide* chapter on 'Diseases of the joints.'

CHAPTER III

THE HYGIENE AND DISEASE OF INFANTS AND CHILDREN

Newly Born Infants.—One of the first cares of the nurse after the navel has been properly attended to should be to direct her attention to the infant's eyes, carefully wiping away, by means of a soft rag, any mucus or vaginal discharge which may adhere, and thoroughly cleansing the eyelids with warm water. This is a matter of much importance and should never be neglected, for if conjunctivitis or a purulent ophthalmia be set up, much trouble may ensue and some time elapse before a healthy state is again attained, and the risk of corneal opacities and consequent loss of sight is by no means small. The temperature of the room in which mother and infant are should be maintained, at least in winter, at 65°, and means be taken to thoroughly ventilate it without producing draughts.

In giving the infant its first bath—necessary on account of the slimy whitish secretion with which the infant is covered—care should be taken that it is done before a good fire, and that the water of the bath is not too warm; the temperature should not exceed 95°; the infant's skin is exceedingly tender, and hot baths are liable to give rise to urticaria or even pemphigus. The infant is usually given a daily bath in order to secure cleanliness, especially about the genital organs and buttocks, which are kept by contact with the diapers, and nothing is more likely to give rise to eczema and intertrigo than the skin being smeared with decomposing urine. Some infants' skins are far more tender than others and liable to eczema, and require constant care to avoid irritation. For such, care should be taken in the selection of a soap which is free from excess of alkali, such as the best class of pure Castile soaps, or Urra's 'saver fatty' soap, all excess being removed in the bath. The skin should be carefully dried with a soft towel, and some fine denting powder applied to the folds of the groin and buttocks. This may consist of finely powdered maize or oatmeal mixed with 2 per cent. of salicylic acid, 5 per cent. of benzoic acid or thymol, to prevent any tendency to decomposition. Pure boracic acid, as in the 'Sanitary rose powder,' answers very well, and as it is soluble in water is easily removed by washing. The diapers should be of a soft and absorbent material; at least a dozen should be provided for use during the twenty-four hours.

In the first few days, before the cord has separated, a flannel binder loosely applied is necessary to protect it and keep the dressings in position; but afterwards all binders should be avoided; at least, nothing tight should

be applied round the abdomen which would cause discomfort to the child by compressing the abdominal viscera. The cord may be dressed with a pad of wool-wool wadding or Gargecze tissue.

It is hardly needful to say that a cot should be provided for the infant with a firm mattress protected by a waterproof covering, and under no circumstances whatever should the infant be allowed to sleep in bed with its parents or nurse; fatal accidents through suffocation of the infant beneath the bedclothes are constantly occurring in consequence of the mother falling asleep with her infant in bed with her.

Clothing.—All the clothing should be loose, and as far as possible consist of woven or knitted woollen material, but it will have to be protected from being soaked by the discharges by means of napkins, which may be made of 'seaweed' or similar material. The common tendency is to load the chest and body with too great an amount of clothes and to leave the legs and thighs too much exposed. For the latter, long loosely fitting woollen drawers coming to the waist should be used, carefully protected by the diaper from being wetted.

Infant Feeding at the Breast.—The natural food of an infant is the milk from the breast of its mother, no kind of food being thought of for the first eight or nine months of its life. The mother's health may of course sooner or later interfere with the performance of this duty to her infant, but it is of great importance that it should be attempted, if for only a few weeks or months, for to undertake the artificial feeding of an infant from the first is to expose it to serious risk.

The infant should be put to the breast a few hours after birth, after the mother has somewhat recovered from the pains and fatigue of labour, and has had some sleep. It is of much importance that both mother and infant should get as much rest at night as possible, and if the infant frequently wakes crying, every means should be taken to lull it off to sleep again, and for this a little sweetened water or barley water may be used. It is not unlikely that for the first few days, especially in primiparae, the supply of milk will be scanty and the infant will hardly get its full supply; but this is a matter of little importance, and it is in many respects well not to overload the stomach at first, but to give it an opportunity of gradually accustoming itself to its new function.

From the very first it is of importance to accustom both infant and mother to regular times for feeding. At first, every two hours during the daytime will be quite often enough for an infant of average weight and strength. A longer interval may be taken is the right, so as to give the mother as long a sleep as possible; ten feedings in the twenty-four hours will be sufficient. A strong newly born infant empties the breasts in about fifteen minutes, and, during this time, takes from 1 to 1½ oz. of milk, the total amount taken in the twenty-four hours during the first week being 10 to 12 oz. The infant's stomach, in this period, being only capable of holding about 1½ oz. (see fig. 1) without marked distension, too rapid filling of the stomach with food is very likely to give rise to vomiting. It is therefore of importance for the mother to feed the infant slowly, extending the time to fifteen or twenty minutes. We must not forget that probably rapid absorption is going on during the time the infant is being fed, in strong and

vigorous children, so that it may often happen that such will take more than the above amounts without injury.

The infant's stomach rapidly enlarges, and the secretion of milk increases as time goes on; so that, after the first week or two, eight nursings in the twenty-four hours—that is, every two and a half hours during the day, and a longer interval at night—will be often enough. From the beginning of the third month till the end of lactation, every three hours will be often enough, some 3 to 6 oz. being taken at a time, and some 30 to 40 oz. in the twenty-four hours. Six to seven nursings in the twenty-four hours will be sufficient.

Too frequent nursing is bad for the infant, inasmuch as an overworked stomach cannot properly perform its functions, and a *dyspepsia* is only too likely to result; the mother's breasts require an interval of rest, for, if too frequently drawn, the milk is apt to be unequal in composition, too watery after a long, and too rich and concentrated after a short interval.

During the whole time the infant is being nursed the health of the mother will necessarily be a question of the greatest importance, as it is impossible for a weakly mother, or one in ill health, to give good milk. The food which she takes and the life which she leads are all-important. Anything causing indigestion in the mother will be extremely likely to affect the breast milk and disturb the infant's digestive organs.

Various drugs, such as morphia and Epsom salts, when taken by the mother, are excreted in the milk, and may of course affect the infant. Any violent emotion, such as a great sorrow or any prolonged anxiety suffered by the mother, is very likely to alter the quality of the milk, and the infant consequently suffers. Indeed, under these circumstances, the milk may cease to be secreted, and the infant have to be artificially fed. The mother's diet should consist largely of milk, porridge, soups, potatoes, fish, and light puddings, while beef, mutton, and stewed fruit should be taken in moderation. She should avoid all highly seasoned foods, and those difficult to digest, such as pastry, raw fruit, uncooked vegetables. Alcoholic liquors are unnecessary, and tea and coffee should be taken in moderation. Exercise in the open air is of the greatest importance.

According to Forster, increasing the amount of fat taken as food does not increase the amount of fatty matters in the milk secreted, while proteins taken increase the fat in milk. For the mother or wet nurse excessive quantities of food should certainly be avoided, and, especially if she is much confined to the house, much meat should not be taken.

The milk of the first few days differs from normal milk in that it has a higher specific gravity, contains more salts, less sugar, and is coagulated by means of heat in consequence of the large amount of albumen which it contains. This albumen is apt to set up more or less *dyspepsia* or *diarrhea*. In a few days the excessive quantity of albumen disappears and the milk becomes normal. The changes which occur in the quality of the milk during the lactation period depend very largely of course on the health of the mother. During the later months of lactation the milk becomes poorer and more watery, with a tendency, according to Pfeiffer, to a diminution of the proteins and an increase of the sugar. It must be borne in mind how completely the secretion of the milk is under the influence of the nervous system, and, moreover, it varies from time to time from various causes; and more

or less caution must be observed in drawing conclusions as to the effect of any one case on the quality of the milk.

The occurrence of menstruation in a nursing mother or wet nurse is apt in some way or other to alter the secretion of the milk, and the infant, in consequence, may suffer from colic, flatulence, or diarrhoea. In many cases the infant does not appear to suffer at all, while in exceptional cases the intestinal disturbances and loss of flesh are so great that the question of weaning may have to be entertained. It may happen that the infant may suffer a good deal at one period and rest at the next or succeeding ones. The chemical changes which occur during menstruation have been investigated by several observers, but no constant change has been found. In some cases the careful observations of Koch have shown that the milk during this period is poorer in fat and richer in protein, but it is tolerably certain that this is not universally the case. Most found that menstruation exercised no constant change or influence on the specific gravity or the fatty elements, though in some cases observed by him there was an increase in the quantity of fat during the period.

As the result of numerous observations, Schlichter found that the casein and fat were slightly increased, and the proteins, sugar, and solids were decreased, during menstruation; but as just as great changes were observed from time to time during the intervals between the periods, it is evident the changes noted during menstruation cannot be of importance. This author regards menstruation occurring before the sixth week as likely to affect the well-being of the infant by causing serious changes in the milk; on the other hand, menstruation occurring at a later period is of comparatively small importance.

Wet Nurses.—It not infrequently happens that, if an infant's life is to be saved, a wet nurse must be procured. It may happen that a weakly infant is deprived of its mother's milk, and a foster mother must be obtained if its life is to be saved. In some cases, perhaps, an attempt has been made to feed a young infant on some artificial food, various foods being tried, one after another, till severe convulsions or continuous diarrhoea warn the attendants that a return to the infant's natural food is the only possible resource left. Much has been written about the advantages and disadvantages of a wet nurse. We may say at once that, in our opinion, there is not the least doubt that no artificial food yet devised can compare with or form a substitute for the milk of a healthy woman. To attempt to bring up a weakly infant from the first on artificial food is to expose it to far more serious risks than if it is provided with a healthy wet nurse. Unfortunately in this country wet nurses are difficult to obtain, and when obtained are not always easy to manage in the household. At the same time, we are inclined to think that the character of wet nurses as a class has often been painted in too black colours; certainly we have known many who have done their duty to their foster infants in a most worthy and exemplary manner. A difficulty often is presented with regard to the nurse's own child; it is put out to nurse, and is deprived not only of its mother's milk, but also of its mother's care, and is only too likely to go the way that so many 'out-to-nurse' babies have gone before. In large cities wet nurses are usually obtained at the workhouses, where many women go to be confined, and are often glad to

escape from the discipline of the workhouse, and to obtain a situation in a private family at good wages.

A wet nurse should *not* be above thirty-five or below twenty-one years of age; very young wet nurses are especially to be avoided, on account of their inexperience and the difficulty in managing them. It is better for the nurse's infant to be a month or so older than the infant to be nursed. Great disparity of age is an objection, as a nurse who has been confined five or six months before is not likely to make a good nurse for a newly born infant, at least not for the whole time that the infant has to be nursed; but such a nurse may be employed temporarily in the absence of a more suitable one. A disparity of two or three months is no objection, provided the nurse is suitable in other ways. A medical examination of the nurse should always be made—at least, the medical attendant should satisfy himself that both the nurse and her infant are free from disease. There is one advantage in the nurse's infant being two or three months old, and that is that time would have been afforded for any syphilitic rash to make its appearance on the infant, and the infant if strong and vigorous is reliable evidence of the good quality of the milk. If possible, an analysis of her milk should be made upon several occasions, especially with regard to the amount of fat present in the milk. But, in spite of all precautions, we must be prepared at times to find that the milk of a wet nurse who in every way appears suitable does not agree with the infant, and the only resource is to try another. Great pains must be taken in the dieting of the nurse, errors being most frequent in the direction of overfeeding with too little exercise. Meat once a day is enough, beer and porter are best avoided, and exercise in the open air must be insisted on.

No infant suffering from hereditary syphilis should be wet-nursed, on account of the risk of its infecting its foster mother.

Weaning.—The length of time during which the infant takes its sole nourishment from its mother's breast depends upon a variety of circumstances. When the mother remains strong and healthy and has a sufficient supply, the time may be extended to eight or nine months, or even more. Among the working classes the time is often extended much longer than this. Infants who are over-nursed are apt to be fat, but are not necessarily strong—indeed, they often appear rickety in a minor degree. In a case recently coming under our notice, the mother nursed her infant entirely at the breast for seventeen months. The child weighed twenty pounds, it showed signs of rickets, the epiphyses being moderately enlarged and the ribs beaded. An examination of the mother's milk, which was plentiful, showed it was poor—the amount of fat (average of three samples) 1·7 per cent.; the specific gravity was 1051.

Whenever weaning takes place it is wise to do it gradually, in the first place substituting the bottle for the breast once or twice in the twenty-four hours, and carefully watching the result before attempting more than this. Gradually artificial feeding may be made to take the place of the breast entirely. It is well to avoid the hottest weather for this change on account of the risks of diarrhoea at this time.

At any time during the period of lactation it may be necessary, on account of the mother's health, or supplement nursing with other food, or to

give up nursing altogether. The question of whether to give up nursing or not is often a difficult one to decide. If the mother is suffering from any organic disease, there cannot be any doubt as to giving up nursing both for her own sake and that of the infant. It may happen that the breast milk entirely goes, and either a wet nurse must be obtained, or artificial food be substituted; in other cases the decision is much more difficult; the infant does not appear to thrive, and the fault may be in the quality of the mother's milk.

Much useful information may be gained by weighing the infant every week; a regular gain of 3 to 6 ounces a week during the first three or four and 3 to 4 ounces from the third to the sixth month will indicate that the infant is thriving in spite of some minor troubles it may be subject to. It must be remembered, however, that the infant may put on fat without a corresponding development in the other tissues. One of Salter's family spring balances with oblong pan capable of weighing 25 lbs. by 1 ounce will answer very well for the purpose.

Valuable information may be obtained by an examination of the breast milk; unfortunately, no mere inspection or microscopical examination is of any use; an analysis must be made by a competent chemist by ordinary methods, or approximate results may be attained by the methods referred to below. Moreover, it will be necessary to have several analyses made before coming to any definite conclusion. Care should be exercised to see that the milk taken for analysis is the middle portion; that is, the infant should be put to the breast for five minutes or more, and then 3-4 oz. drawn from the same breast by means of a breast pump. This will give a fair sample of the milk. The two most important constituents, as Koch points out, are the amount of fat and the amount of proteins present. A low proportion of fat and a high proportion of proteins indicate a bad milk.

The following examples, taken from Koch, represent examples of (I.) normal milk, (II.) poor milk, (III.) over-rich milk, (IV.) bad milk:

	I.	II.	III.	IV.
Fat	4	1.50	3.10	0.80
Proteids	1.2	2.40	3.50	4.50
Lactose	7	4.00	2.50	1.00
Ash	0.2	0.00	0.25	0.05
Total solids	12.83	7.90	10.35	6.35
Water	87.17	92.01	89.65	93.65
	100.00	100.00	100.00	100.00

Recently Meib has published the results of his examinations of the milk of 300 women by taking the specific gravity, reaction, and estimating the fat by means of Marchand's lactofatymeter.¹

Ernest Hoff has suggested the employment of a creamer and taking

¹ *Zeitschr. für Kinderheilkunde*. Band xiv. page 1. We have employed this apparatus on many occasions, both for cow's and also human milk, and though we cannot say it is satisfactory in every respect, yet, if care be used, it will give the percentage of fat in milk fairly correctly.

the specific gravity, as guides in forming an opinion as to the quality of the milk. (For other methods see Appendix.)

Artificial Feeding.

The most convenient substitute for human milk is the milk of the cow. The milk of some other animals, such as the goat, ass, mare, has been used with more or less advantage, but cow's milk is likely to remain the all but universal substitute. Goat's milk has one or two practical advantages; in the first place, the goat is said not to suffer from tuberculosis, while the cow is known to be very liable to this disease; and in the second place, for a family in the country having their own grass plot, it may be often very convenient to purchase a milk goat and fodder it at home. A milk goat is of course much cheaper than a cow, and can be kept at practically no expense. The chemical differences between the milk of the cow and that of the goat are not great, and there is no advantage except that already mentioned in substituting goat's milk for cow's milk.

The milk of the ass much more nearly resembles human milk than either the milk of the cow or goat. Unfortunately asses' milk is difficult to obtain in this country, and is also costly.

Cow's Milk.—The milk of the cow has been studied more closely than the milk of any other animal, on account of its great importance to the community as an article of commerce. As a food its importance is derived from the fact that it supplies in due proportion proteins, carbohydrates, hydro-carbons, salts and wastes, while it contains no waste products, and, moreover, it is digested with comparative ease. It requires when fresh no preparation to render it fit for consumption.

The richness of milk is influenced in various ways—the materials with which the cows are fed, the length of time during which they have been in milk, and also by the breed. The milk supplied at our doors, it is needless to say, varies with the honesty of the purveyor and the cleanliness observed in its collection and transit.

We give here three different analyses of cow's milk: (I) a good average specimen according to Leeds; (II) a pure milk according to Langlois; (III) an average specimen as supplied by the milkmen of Paris (Langlois):

	I.	II.	III.
Specific gravity	1009.7	1031.7	1035
Vol. of cream		10	7.7
Fat	3.75	4	3.34
Lactose	4.43	5	4.92
Proteins	3.76	3.4	3.4
Ash	.65	.6	.57
Total solids	12.61	13.0	12.23

The **Fat** of milk consists principally of margarine and oleine; it is present in milk as minute globules, which are standing due to the surface

the form of cream. A microscopical examination of a drop of milk displays these minute globules of fat, and also colostric corpuscles and fatty epithelial cells if the animal has recently calved. According to some the fatty globules are surrounded by an albuminous envelope; others believe milk to be really an emulsion, in which the fatty particles are held in suspension by the albumen and caseinogen in the milk. The fat can be extracted by shaking with ether, after the addition of a drop or two of a solution of caustic potash. If milk be long heated at 100° C. or at a higher temperature, the emulsion is in part interfered with, and globules of butter oil will rise to the top if the milk is warmed; a microscopical examination of such milk will show the fatty globules have in part run together.

The **Lactase** is the member of the carbo-hydrate group present in milk, and is destined to be in part converted into lactic acid in the stomach, whilst the rest is converted into glucose in the intestines, and in this state enters the blood of the portal vein. The former process is the result of the action of the 'lactic acid bacillus'; but there are numerous varieties of micro-organisms which are capable of converting lactose into lactic acid. Lactic acid appears to be always present in normal digestion in the stomach, but in some forms of dyspepsia excessive quantities are formed, so that some infants who are suffering from chronic dyspepsia have a strong 'sour milk' odour. Possibly this rancid smell may be due in part to butyric acid. Lactic acid may be decomposed into alcohol and carbonic acid, and also into butyric acid and carbonic acid. The latter two processes probably only take place in abnormal digestion.

The **Proteids** of milk are two in number—caseinogen and lactalbumen (Halliburton). In cow's milk the former is present in much larger quantities than the latter, the reverse holding good in woman's and goat's milk. Caseinogen is precipitated by acetic acid or by saturating with a neutral salt such as sulphate of magnesium; lactalbumen is coagulated on boiling. Lactalbumen closely resembles serum albumen, but it coagulates at a somewhat higher temperature, 77° C. (Halliburton). It only slowly coagulates at this temperature, and even at a higher temperature some time is required to fully coagulate it.

If rennet be added to cow's milk the caseinogen is decomposed into casein or curd of milk, which is precipitated in dense flakes, and a second proteid, the ' **whey proteid** ' which remains in solution. The presence of lime salt is necessary for this change to take place (Hammarsten).

'Whey proteid' is not precipitated by heat. It is probably this '**whey proteid**' which sometimes appears as small curds in the stools of newly born children and others who are being fed exclusively on whey.

The curd of cow's milk forms a dense heavy lumpy precipitate in the stomach, differing very markedly from the soft flocculent precipitate from woman's milk. According to Langlet's the ferment in the stomach precipitates the curd but does not dissolve it, the curd passing unchanged into the intestines, where it is converted into peptone by the action of the pancreatic juice; this view, however, is not universally accepted. Various bacteria have the power of converting casein into peptone and ptomaines.

The **Salts** of milk consist of potash, lime, and soda in combination with phosphoric acid and chlorine.

We may know that the milk supplied to our homes is unadulterated, having been neither watered nor "let down" by admixture with skimmed milk, but for the most part we have to take in good faith that the cows are healthy and carefully fed, and that the most scrupulous care has been observed with regard to cleanliness in the milking of the cows and in the conveyance and storage of the milk. Unfortunately, our confidence is at times misplaced. We find that in the winter time the cows are fed with the idea of forcing them to yield the greatest quantity of milk, without any regard to its suitability for the food of infants: turnips and brewer's grains being used largely instead of hay, maize, or other dry fodder. In the summer time the cows graze in fields which are perhaps watered by town sewage, in which the cows may lie down and become befouled. The sheds or byres may be badly ventilated and much filth may be allowed to accumulate in them, and the cows may become beset with excrement. Small wonder is it that the milk supplied contains hair, fragments of excrement, bits of hay and straw, sand and grit, and as a consequence of these contaminations, if kept for any time, swarms with organisms.

Great care should be taken to select a milkman who takes a pride in the feeding and cleanliness of his cows, and will take some trouble to deliver the milk as quickly as possible after milking. It is a good plan to have a private milk can, and to get the farmer to milk his cow directly into this can and to deliver at once.

Woman's Milk.—The following figures, according to Leeds, represent the principal differences between cow's and woman's milk:

	Sound dairy milk.	Average woman's milk:
Reaction	acid	alkaline
Specific gravity	1029	1031
Fat	3.75	4.13
Lactose	4.42	7
Proteids	3.76	2
Ash	68	3
Bacteria	numerous	about

We have taken the analyses of Professor Leeds of woman's milk as being the average of a large number of specimens, but the variations in different samples is very considerable. The analyses given by different authorities also differ largely. Dr. Luff's analyses of twelve samples made for Dr. Cheate show on an average a less rich milk than the results of Professor Leeds' analyses given above—viz. fat, 2.41; lactose, 6.32; proteids, 2.35; ash, .32.

The principal points to be noted are the following: (1) The excess of proteids in cow's milk, and the excess of curd (caseinogen) over lactalbumen as compared with woman's milk. According to Hirt, the amount of curd in cow's milk is 3 per cent. (lactalbumen 75 per cent.), in woman's milk it is only .63 per cent. (lactalbumen 1.5 per cent.), so that the amount of curd is nearly five times as great in the former as in the latter. (2) Smaller quantity of lactose in cow's milk. (3) The fat is (?) slightly higher in woman's milk. (4) The ash is greater in cow's milk. (5) By the time the cow's milk reaches

the consumer it is slightly acid and contains numerous bacteria, while woman's milk is supplied direct to the infant, and is alkaline and sterile.

In substituting cow's milk for human milk, we necessarily endeavour to imitate the latter as much as possible. The great difficulty on the score is in the large quantity and solidity of the curd which is thrown down in cow's milk when the latter comes in contact with the walls of the infant's stomach. Woman's milk curdles in soft flakes, which hardly offer any resistance when pressed between the tongue and throat, while the curd of cow's milk, especially if the curdling has been rapid, consists of firm cheesy lumps. The digestive juices of the infant's stomach and intestines are unable to dissolve these lumps, and, if not vomited, they partially decompose under the influence of the bacteria they contain; gases and poisons are formed, and much discomfort and perhaps diarrhoea or colic sometimes take place before the decomposing curd is passed in the stools. Anyone who has had an opportunity of carefully watching the effects of cow's milk when taken by an infant a few days old, and noted the effect if the milk of a wet nurse is substituted for cow's milk, will see at once the difference in the quality of the stools, and the immediate cessation of the discomfort and indigestion which the infant is certain to have suffered when taking the cow's milk. The difficulty with regard to the curd can partly be got over by diluting and peptonizing or adding milk extract, but no method has been discovered by which cow's milk can be rendered as digestible and nutritive as woman's milk. The curd thrown down from condensed milk, or milk which has been deacidified, appears to digest more readily and with less discomfort than the curd of fresh cow's milk.

Cream Mixture.—While the readiest way to prepare an infant's food from cow's milk is to dilute with water and add sugar, it is plain that the diluted milk will be deficient in fat, as compared with breast milk. To make good this fat, cream may be added. But here the practical difficulty which confronts us is the uncertainty of obtaining fresh cream of a definite strength. Cream which has been skimmed off milk after standing for twenty-four hours is too stale for use as infant's food, and much of the cream sold in bottles is by no means sterile and of very uncertain strength. We believe the best way to prepare an infant's food from cow's milk in the household so as to render it as near breast milk as possible is to adopt the following method, which is a modification of that suggested by Meigs. A pint or a pint and a half bottle such as the one in fig. 8 is filled to the upper mark with milk as soon as it arrives. A plug of pure cotton wool is placed in the neck, and the bottle is allowed to stand at the temperature of an ordinary sitting-room for two hours. By the end of that time a certain amount of cream will have risen to the top. The lower half is then syphoned off with a glass syphon, and replaced with an equal quantity of a seven-per-cent. solution of sugar of milk.¹ The milk in the bottle is then sterilized at 160° F. for twenty minutes in Hawksley's or a similarly constructed sterilizer (see Appendix). The bottle is then cooled rapidly in running water and kept in as cool a place as possible. The food should be warmed up

¹ This may be made approximately by taking two measures of sugar and adding seven measures of milk to make fifteen measures in all.

just before using; all food warmers, which keep the food warm for some hours are out of account to be used. It is well to use the milk within twenty-four hours.

Perhaps a simpler method than the above is to allow the milk to stand in a cylindrical tin with a small stopcock fitted in the bottom; the lower half is drawn off, after standing for two hours, through the stopcock. If the milk supplied to the household be a good average one, containing, say, 35 per cent. of fat, then the food as made above will be found to contain 2.0 to 3 per cent. of fat, 5 to 8 per cent. of sugar, and 17 to 2 per cent. of proteins. A twentieth of its volume of lime water may be placed in the bottle when the infant is fed.

A more certain result can be obtained by the use of a centrifugal cream separator. This apparatus is now much employed by the better class of dairymen. A certain quantity of milk is passed through the separator; the result being cream and separated milk, the latter containing only a very small percentage of fat. The whole of the cream is mixed with half the separated milk, and an equal quantity of an 8 or 9 per cent. solution of sugar or milk is added.



FIG. 1.

Some separators can be arranged to supply a mixture of the whole cream with half the separated milk, and if milk and water in equal quantities is supplied to the separator instead of pure milk, the whole of the cream—that is nearly all the fat in the milk, leaves the separator with one half of the milk and water, while the other half is very nearly pure fat. It is evident that the former will have all the fat, half the casein, half the sugar, and half the salts. Sugar can be added—either milk sugar or cane sugar.

Both Hodart and Retz have also strongly recommended mixtures containing cream, milk, lime water, and sugar. Retz suggests the following mixture:

Cream	1 ounce	Lime water	1 ounce
Milk	1 ounce	Milk sugar	2 teaspoons
Water	2 ounces		

Cream is mostly digested well by infants if the proportion of fat in the food is kept below 3 per cent, and too much food is not given to the infant. Food too rich in fat may give rise to vomiting and diarrhoea, and possibly gastric catarrh.

Diluted Milk.—Undoubtedly the readiest way to prepare an infant's food is to dilute milk with water, and lime water, and add sugar. That food so prepared is inferior to the foods in which cream forms the basis is evident, yet it cannot be denied that very many children are brought up on diluted cow's milk and appear to thrive on it. Many such children pass much time in their stools without being the worse for it. The poorer classes cannot get fresh cream, or indeed any cream at all, and have from necessity to prepare their infants' food from milk. As we should naturally suppose, it is

the newly born infants who are most intolerant of cow's milk, and great care is required in adapting the strength of the milk to the infant's condition. It is necessary at first to dilute cow's milk with two-thirds sugar water,¹ one-twentieth part consisting of added lime water, so as to secure that the food should be fairly alkaline. We should, however, much prefer to give a newly born baby whey and cream or diluted peptonised milk if it is necessary to feed it artificially.

After the first three or four weeks, if the infant's digestion appears good, half milk and half sugar water² may be given, (one-twentieth part being lime water). From three months of age to six months, one-third part of sugar water should be added.

Barley Water, Oatmeal Water, &c.—For many years past it has been the practice to use certain thin gelatinous fluids, such as barley water, oatmeal water, arrowroot water, or fluids containing maltose and dextrin, to dilute milk with for infant feeding. All these fluids, except perhaps the last named, contain small quantities of starch. Now it is certain that the powers of young infants for converting starch into sugar are feeble, and if these fluids are used care should be taken in their preparation to avoid any quantity of starch being present. The saliva of infants three or four months old has undoubted powers of starch transformation, and apparently the pancreatic and intestinal juices have also, so that by the time this age is reached we have nothing to fear from thin starchy fluids. It has been claimed for these gelatinous fluids that when used to dilute milk they play a useful part in preventing the curd from running together into lumps during the time that coagulation is taking place. It is certainly difficult to demonstrate this in a test tube, but it is probable that any colloidal or gelatinous fluid combined with the rapid diffusion of the acid and curdling ferment through the fluid, and consequently the curdling takes place slowly, and there is in consequence less tendency to the formation of lumps of curd. Neither starch nor maltose is present in the natural food of infants, yet experience teaches that the addition of a thin malted food or barley or oatmeal water has a considerable nutritive value, and we entertain no doubt on this point. For infants below six months of age, we dilute milk more or less in order to reduce the amount of curd present; in doing so we render the food poorer in hydrocarbons than mother's milk. This diluted milk is rendered more nutritive by the addition of washed starch, and this is, in some instances at least, more readily assimilated than milk diluted with water only.

Whey.—Whey is a useful substitute for mother's milk in those cases where for a few hours or for a day or two milk fails to appear in the breasts. Unboiled whey contains fat, lactalbumin, whey protein, lactose, and some of the salts of milk. Where a weak food is required whey often answers admirably, when made from fresh milk. Some sugar of milk may be added. Care should be taken in preparing the whey to use contact or an artificial curdling fluid free from an excess of salt, as brine is often used to prepare the artificial curd.

Peptonised Milk.—The predigestion of the curd, or rather the catenolysis of cow's milk, is undoubtedly a useful resort in the artificial feeding of infants. It can be easily demonstrated that milk partially peptonised has

¹ 2 per cent. solution of milk sugar.

² 2 per cent. solution of milk sugar.

readily curdles on the addition of rennet or acid, and that the curd thrown down is softer than that thrown down from fresh cow's milk. Clinical experience also testifies to its value, especially in infants with irritable stomachs or gastric catarrh. Some infants will, however, continue to pass curd in their stools while taking peptonized milk properly prepared, and at times it appears to disagree, especially when carelessly prepared. Infants will also often appear to thrive on it for awhile and become well nourished, but if it continues to be the sole food for many months together, they are apt to become anemic, and suffer from various hemorrhages. (See Scurvy-rickets.)

Great care should be bestowed on its preparation, so that the digesting process may be carried far enough, but not too far. In the latter case a bitter taste becomes well marked, which is with difficulty covered.

The best way to prepare this form of food is to utilize the cream mixture already referred to, and also the sterilizing apparatus. A reliable peptonizing powder containing purest *monobasic sodium* may be added to the mixture when nicely warm (110° F.), and the temperature raised during the next ten minutes or quarter of an hour to 160° F., when the process is complete. Or the temperature may be carried to the boiling point.

Peptonized milk food may be prepared from one of the well-known foods prepared by Benger & Co. or other reliable firms.

Sterilization.—Where milk can be obtained absolutely fresh and uncontaminated from undoubtedly healthy cows, and is consumed at once, sterilizing processes are of course unnecessary, but only infants resident in the country, where cows are kept on the premises, can have these advantages. Cow's milk, as it is received by householders in towns, is usually many hours old before it is received, and it may be kept, or at least some portions of it, for twenty-five hours longer before the infant takes it. During this time the bacteria which it has received by means of various contaminations multiply enormously, especially in hot weather. Milk which is acid and 'just on the turn' is, it is needless to say, quite unfit for infants' food. Many of the bacteria found in stale milk are probably harmless, or at any rate not actively mischievous; others which may be present, especially the 'peptonizing bacteria,' are unquestionably deleterious, inasmuch as they form during their growth various animal poisons of the ptomaine type, which give rise when taken to acute diarrhea or gastro-enteritis.

Various pathogenic bacteria may be present in milk, either derived from a diseased cow, or from sewage or other contamination entering the milk. Tubercle bacilli may be derived from cows suffering from tuberculosis of the udder, and there can be no doubt that diphtheria, scarlet fever, typhoid fever, and foot and mouth disease may be spread through contaminated milk. Fortunately all these bacteria are destroyed at a temperature of boiling water; indeed, there is good evidence that they cannot withstand a temperature of 70° C. if continued for half an hour. Of the saprophytic bacteria there are many varieties. There are the lactic acid group, and with these are the butyric acid producers. Others, which are much more important, are those which do not act on the lactose, but if present in sufficient numbers peptonize the proteids, forming peptones and albumoses. Milk containing the latter if it is at all stale given to mice or guinea pigs produces diarrhea, while pure cultures quickly produce diarrhea and death.

Sterilising for household purposes rests on a somewhat different footing than sterilising in large establishments, where the milk has to keep for many months. The milk sterilised in the household has only to be kept for twenty-four hours or thereabouts, and therefore so high or continuous a temperature is not required. The success of the sterilising process largely depends upon getting the milk fresh and clean, and consequently containing few bacteria and no spores. It is impossible in a household to sterilise stale milk. Stale milk is certain to contain many spores, and the spores of some of the saprophytic bacteria such as those which attack casein require a temperature of 100-105° C. or more to destroy them. If the milk can be procured fresh and clean and is intended to be consumed within a day or two, a temperature of 70° or 75° C. is quite high enough to expose the milk to. This temperature does not affect the taste or coagulate the lactalbumen. If milk has to be kept a longer time or is not very fresh, it is better to expose it to a temperature of 100° C. for half an hour. Milk which is long heated at 100° C., or especially at a higher temperature suffers certain changes, the chief of which is connected with the coagulation of the albumen and the partial destruction of the fat emulsion. In such milks some of the fat floats in the form of large globules of butter on the top of the milk when it is warmed. A brown colour is developed on account of the partial destruction of the lactose. Milk long heated suffers coagulation less perfectly than raw milk; this is due to the precipitation of some of the calcium salts. There can be no doubt that the formation of the butter oil is a disadvantage; how far the less perfect coagulation of the curd is an advantage it is impossible to say.

Various forms of apparatus have been devised for sterilisation in the household, the best known being on the Soxhlet type. This form can be used for heating to 100° C. or to the lower temperature of 70° C. Harejaky has also devised a steriliser with a thermometer, which is convenient and reliable. (See Appendix.)

Condensed Milk.—Condensed milk has long been a favourite substitute for mother's milk among the lower classes, and its use is by no means confined to the lower orders, though it has had but few defenders among medical men. The fact that some brands contain a large proportion of added cane sugar has condemned it in the eyes of most medical writers, and many serious allegations have been made against it. It has been accused of producing eczema, diarrhoea, constipation, rickets, scurvy, and it has been alleged that while children who have been brought up on it are fat and plump, they readily succumb when attacked with acute disease. That it is a favourite food among the lower classes there can be no doubt; it is convenient, it does not readily turn sour, and it may often be substituted for fresh cow's milk when the latter causes vomiting, with good effect. The reason of its being useful in gastric catarrh, not being retained when cow's milk and water have been, is probably that the condensed milk, as generally mixed, contains less acid than the mixture of fresh cow's milk previously used; it seems certain also that the casein of condensed milk is more slowly thrown down than the casein of fresh milk.

Moreover, it is sterile, and the best brands have been prepared from fresh rich milk. We believe that while it may often be substituted for fresh cow's milk with advantage, we should deprecate its use for many months together, if given as the sole food.

In using condensed milks accurate directions must be given as to the strength to be employed and also as to the manner of measuring it. A graduated measure should be employed and the milk poured into it. For an infant of three months old it may be diluted 1 in 3 by weight, or what is nearly equivalent to this, 1 in 10 by measure. It should rarely be used stronger than this, but it may be necessary to dilute to 1 in 15 or 20 for very young infants, or in special cases.

Diluted to 1 in 8 by weight, we shall have the following composition (Leeds):

	Condensed milk	Diluted 1 in 8 by weight
Fat	12.30	1.54
Lactose	66.62	2.06
Cane sugar	22.26	2.78
Proteids	16.07	2.01
Ash	2.61	.38
Total solids	69.66	8.63

It is important only to use a good brand of condensed milk, inasmuch as the cheaper forms are deficient in fat. The 'Milkmaid' brand contains nearly 12 per cent. of fat, while some other brands have less than 2 per cent.

Some good brands of condensed milk may be obtained without added sugar. The following is an analysis of the 'Viking' brand; it will be seen that it corresponds with a good milk which has been concentrated by driving off two-thirds of the water. A measured ounce of this milk weighs 450 grs., that is one-tenth more than an ounce of water. It can be diluted for use 1 in 2 or 6 by measure.

	Unsweetened condensed milk	Diluted 1 in 6 by weight
Fat	9.9	1.65
Lactose	13.1	2.2
Proteids	6.9	1.5
Ash	1.9	.36
Solids	34.9	5.51

It will be seen by examining the second column that each of these foods is deficient in fat, while the latter is deficient in carbohydrates, but this can be remedied by adding sugar. It is well to bear in mind that in all concentrated or desiccated milks the calcium phosphates are thrown down in a more or less insoluble form, and in preparing the food in the ordinary way are only in part re-dissolved.

Dried Milk Foods.—The difficulties attendant on the preparation and storage of sterilized milk for sale, have brought into the market various preparations of desiccated milk. These will keep good in any climate, and occupy only a small bulk as compared with liquid preparations. They are unquestionably convenient, are sterile, and their proteids are more readily digestible than the proteids of milk that passes as fresh milk. Messrs. Allen & Hanbury prepare two forms of desiccated milk food. In these preparations the percentage of the proteids (both casein and albumen), also fat and sugar, is the same as in human milk. In No. 1 food a small quantity of malt extract is added. The following analysis is from the 'Lancet':

	No. 1 Food (No. 1 Food)	Diluted (No. 1 Food)
Fat	15.15	1.64
Lactose and dextrose	61.48	8.19
Proteids	14.25	1.78
Salts	4.75	0

In using this food accurate directions should be given for its preparation. The useful tablespoon should not be used as a measure, but a dry graduated measure glass. Six measured drachms (250 grs.) of No. 1 food weigh half an ounce, water is to be added to make up 2 oz. is all.

The composition of No. 2 food is very similar. No. 1 is most suitable for the first three months of life, and No. 2 for the next three months. No. 3 food, which consists of a malted starch food and which requires mixing with fresh milk, is best suited for children over six months of age.

Our own experience of these sterilized milk foods is decidedly favorable, and they are as a rule much more readily assimilated than diluted fresh milk, and in some instances answer better than peptonized milk. They are certainly worthy of a trial in those cases where an infant is vomiting or has curdy stools while taking diluted fresh milk, at least as a temporary resort.

Amount of Food to be given.—The amount of food to be given to an infant must necessarily depend not only on its age, but also on its digestive powers and its development. It is evident that it is quite as important to carefully regulate the times of taking food and the amount to be taken, as it is to decide upon the nature of the food. It must of course be borne in mind that the amounts given below are for an infant of average weight and digestive powers. Neither age nor weight should be taken blindly as a guide to the amount of food an infant should take. For the first two or three weeks (weight 6 to 8 lb.), give 1 to 2 ounces of food every two hours and a half in the daytime; 3 bottles being given, and 12 to 15 ounces of food being taken in the twenty-four hours.

During the second month (weight 8 to 11 lb.), 3 to 4 ounces of food every two hours and a half; 4 bottles being given, and 20 to 30 ounces being taken in the twenty-four hours.

During the third and fourth months (weight 11 to 14 lb.), 4 to 5 ounces of food every three hours; 7 bottles being given, and 30 to 35 ounces being taken in the twenty-four hours.

During the fifth and sixth months (weight 14 to 16 lb.), 6 to 7 ounces of food may be given every three hours; 5 bottles being given, and 35 to 40 ounces being taken in the twenty-four hours.

Feeding Bottles.—The simplest feeding bottles are the best. It is wise to avoid all those provided with india-rubber tubes, corks, and those that have indented lenses on their surfaces. The rubber tubes soon crack and become rough inside, corks absorb some of the food and quickly become foul, while any indentations on the inner surface of the bottle make it difficult to wash clean with a brush. The best class of bottles are those with rather wide mouths (see fig. 9) or such as are supplied with Nessler's or Eschschitz's milk sterilizers, and are perfectly plain and fitted with large teats that can be turned inside out for the purpose of cleansing. The small teats supplied with the fancy bottles cannot be readily cleaned. The bottles after being used should be thoroughly cleaned with a brush kept for the purpose, and inverted so that

they may strain and so dust may be allowed to get into them. It is important that the food should not be given too hot; a temperature of 98° F. is quite warm enough.

Diet from 6 to 12 Months.—While many mothers are strong enough, and are sufficiently good nurses, to suckle their children to the end of the first year, there are many others who begin to flag about the 6th or 7th month, and in such cases it is desirable to supplement the breast by means of some milk food. There is no lack of artificial or patent foods from which to choose. If the infant is entirely dependent upon artificial food, it should take from 1½ to 2 pints of good cow's milk every twenty-four hours, between 6 months and 1 year. Whether this should be given sterilized must depend upon the digestive powers of the infant, which may be gauged by its power of digesting cream as determined by an inspection of its stools and by its growth and weight. Some forms of starchy food may be added with advantage, for now the digestive powers of the infant are sufficiently advanced to form dextrine and maltose out of starch, thus forming a valuable and easily assimilated carbohydrate. Care must be taken that all starchy matters are thoroughly boiled, so that the starch granules become gelatinised, as raw starch is less easily digested.

Banley jelly, whole meal flour, maize, oatmeal, all answer very well if thoroughly cooked and made sufficiently thin to pass through the tube of ordinary feeding bottles.

If the digestion of starch is not proceeding well or if curd is being passed in the stools, malt extract or 'Biotin' may be added to the food after it has been boiled, and allowed to become just cool enough to taste; it is then set aside for a few minutes before giving it. Five meals in the twenty-four hours will, as a rule, be sufficient, some 6 to 8 oz. being taken at each meal. The first meal may be taken between 7 and 8 A.M.; the second, between 10 and 11 A.M.; the third, 1 to 2 P.M.; the fourth, from 4 to 5 P.M.; and the fifth, the last thing at night. There is no harm in giving the infant a well-roasted crust or nibble, but thick foods should not be allowed, and beef tea or eggs are certainly unnecessary, and best avoided.

During the 7th, 8th, and 9th months, 3½ oz. to 5 oz. will be an average weekly gain, and by the end of the 9th month 20 lb. weight may be reached. During the last three months 5 oz. to 6½ oz. per week; and the weight is usually over 25 lb. by the end of the first year.

It must not, however, be forgotten that infants may put on fat which naturally adds to their weight without their being necessarily strong and healthy. Care must be taken to weigh them at the same time of day, so that there may be no mistake.

At twelve months of age, if the child be strong and healthy, the bottle may be gradually left off, and food of a more solid character may be substituted, but milk is still to be the staple food.



FIG. 2

Diet from Twelve Months to Eighteen Months of Age.

First meal, 7.30 A.M. Five bread sops with milk, or oatmeal or hominy porridge made with milk.

Second meal, 11 A.M. A drink of milk.

Third meal, 1.30 P.M. Bread crumbs and gravy or a lightly boiled egg and bread and butter. Sago or rice pudding.

Fourth meal, 3.30 P.M. Bread and milk.

Fifth meal. Milk to drink.

After eighteen months of age, when healthy children have out their first set of deciduous teeth, small quantities of fish, fowl, or meat may be allowed. Of fish, boiled whiting, sole, or cod, carefully freed from all the bones, is readily taken by most children. Boiled fowl is better than butcher's meat in early childhood. Of the latter, underdone mutton chops, torn into shreds and mixed with bread crumbs or well-mashed potatoes, form the best and most digestible kind of butcher's meat. Rice, sago, and tapioca puddings, stewed apples, and preserves of various fruits, may be allowed.

Children unfortunately are often strangely fastidious in their tastes, and will frequently take a dislike to many forms of the most digestible foods. It is always well to introduce as much variety as possible into their diet. For older children kidney porridge with meats for breakfast, to be followed by small quantities of bacon or egg, with cocoa or weak tea, are as a rule well digested and are beneficial, provided that the porridge or bread and milk forms the *placide restaurant* of the repast. Soups made in various ways from meat and vegetables form an exceedingly wholesome and digestible meal. Pasty, as a rule, is bad: boiled rice with raisins and stewed fruit of various kinds are much to be preferred.

When the child is old enough to sit up to table at dinner and take meat cut from a joint, the greatest care should be taken to see that the meat is carefully cut up into small pieces before being put into the mouth, and is thoroughly masticated before swallowing. So important is this, that if there is any doubt as to the cutting up by the nurse, it will be well to insist that all the meat should first be put through a mincing machine: the gravy can be afterwards added to it. Masses of half-masticated meat will not be digested if boiled in the usual way, and will be passed almost unchanged in the faeces; and if the food is thus boiled it is less satisfying, and leads to more than is required by the system being consumed. A stout voice always be made against the common practice of giving children biscuits or gingerbread at almost all hours of the day. The stomach requires rest like every other organ in the body, and is certain to become deranged if sweet things are being given at all times.

CHAPTER IV

DISEASES OF THE DIGESTIVE SYSTEM

Examination of the Mouth.—An inspection of the cavity of the mouth and fauces in infants and children is of great importance, and mistakes in diagnosis are exceedingly likely to be made if it is neglected. In newly born infants the mucous membrane of the mouth is comparatively dry, and continues so for the first two or three months of life; the secretion of saliva becomes gradually freer as the glands develop, and the infant begins to dribble, for it is some time before it learns to swallow its saliva and to keep its mouth shut. The lining of the infant's mouth is at first of a dull red colour, and flocculi of milk are often to be seen adhering to it, as the movements of the tongue and lips are imperfect, and there is but little secretion of fluid to cleanse the mucous membrane. All through infancy and early childhood the mucous membrane is exceedingly apt to become the seat of various lesions. The membrane is necessarily delicate, the epithelium is easily injured, and affords a favourable ground for the cultivation of cryptogamic growths and various micro-organisms; hence the frequency with which we find parasitic scurration and various superficial ulcerations and aphthous patches.

Inspection of the mouth of the newly born may reveal various abnormalities, some of minor importance, such as the small millet-seed nodules arranged in the middle of the roof of the mouth, a shortened frenum lingue, or the presence of small clear swellings (ranula) beneath the tongue. Among the important abnormalities may be mentioned—defect palate, or an abnormally high arched roof.

All through early life there is a tendency to hypertrophy of the lymphatic tissues in the naso-pharynx and fauces. It must be borne in mind that the passage through the naso-pharynx in infants is exceedingly narrow, and the presence of adenoid excrescences or enlarged pharyngeal tonsil, which may perhaps be congenital, may seriously interfere with the infant's respiration, and in some instances seem to excite 'crouping fits,' or spasm of the glottis.

Dentition.—The influence of dentition upon the health of the infant depends very much upon the child's constitution. A strong and vigorous infant which has been brought up at the breast will cut its teeth one after another without trouble, and but for the appearance of the teeth through the gums the friends will not be aware that dentition is in progress. On the other hand, if the infant is sickly, weakly, or the victim of hereditary tendencies, the period of dentition will be a period of danger, and the irritation caused

By the pressure of the tooth expanding its socket and cutting through the gum it is very liable to give rise to various forms of disease, the process of dentition acting rather as the exciting than the predisposing cause. The first dentition begins during the middle of the first year, and ends usually by the appearance of the permanent molars in the middle of the third year. In some, without any known cause, the first teeth make their appearance before this time; indeed, it is not infrequent for infants to be born with a tooth already cut; such teeth, however, are imperfectly developed, and consist merely of a thin shell of enamel. Some by no means strong children cut their teeth early. In rickets dentition is delayed; in these cases in which rickets makes its appearance prior to the sixth month, dentition may not commence during the first year, the infant being toothless at a year old. In other cases the infant only becomes rickety towards the end of the first year, when the incisors are perhaps through the gum, and then there follows a long delay.

By the fifth or sixth month saliva is formed in large quantities, so that it is frequently dribbling from the mouth, and the infant is constantly putting its finger into its mouth, as if there were some sort of irritation going on there. Moreover, while up to this period it has taken its food well and slept the whole night without disturbing its mother, it now becomes restless, seldom crying, suffers from dyspepsia and flatulence, and is at times feverish. The gums may become tender, the whole mucous membrane congested, aphthæ appear on the tongue, inside the lips, or on the hard palate, and the infant is feverish and cross to a degree. Perhaps now the edge of a tooth, usually one of the lower middle incisors, will be felt through the gum. Some days or even weeks will perhaps elapse before the edge of the tooth is actually cut. It is a singular fact by no means unusual circumstance for a tooth to advance so as almost to stretch the mucous membrane of the mouth, and then become stationary for some time.

Now while it is the almost daily experience of the practitioner that the process of cutting the first teeth gives rise to various troubles, he knows also that mothers and nurses are ever ready to attribute every childish ailment to the teeth. Many infantile ailments are mysterious in their origin, especially attacks of feverishness, and in children under two years old there is always a tooth nearly cut, or has just been cut, or is about to be cut, to supply the explanation. It is this popular tendency to attribute every childish ailment to the teeth, which explains the ready sale of 'soothing powders.' The danger is that important errors in diet, a patch of psoriasis, or a meningitis may be overlooked if the teeth are allowed to explain everything. While it is unwise to shut our eyes to the disturbance and discomfort produced by a stretched and swollen gum, care is needed to avoid using the explanation of 'teeth cutting' to cover ignorance or itself to satisfy the clamour of an anxious mother for a definite opinion as regards her child's illness. It is a good rule always to seek for an explanation elsewhere than in the teeth, if there is no local lesion in the gum, such as swelling, tenderness, or some evidence of inflammation.

Feverishness.—When the gum is swollen and tender prior to the cutting of a tooth, the infant is apt to be irritable, having fits of crying without any apparent cause, which nothing will pacify; at first gently rubbing the gum

will give ease, but at a later stage this only aggravates the terrible heat, the acutely painful state of the gum. The fever is intermittent, the child being hot and feverish for the most part at night and unable to sleep, while towards morning it cools down and sleeps for a few hours; the temperature may reach 102° or 103° , rarely more. Such attacks may often pass away without the tooth being cut, or may continue for some time after the edge of the tooth has appeared, and before the rest of the tooth has made its way through.

Stomatitis.—The mucous membrane of the mouth, more especially that part of the gum where the tooth is about to appear, the tongue, hard palate, and inside of the cheeks, may be the seat of small superficial ulcers or small spots denuded of epithelium, their surface being of a grey or yellowish colour, and their edges surrounded by a zone of erythematous redness. These spots are evidently sore, and may be the cause of the infant refusing the breast, and crying whenever liquids containing salutes, such as beef tea, are taken.

Enlarged Glands.—Occasionally it happens in children predisposed to glandular enlargement, that the irritation caused by these aphthous patches gives rise to a swelling of the glands, either the submaxillary when the lower jaw is affected, or the parotid or upper cervical lymphatic glands, which receive the lymph from the upper jaw. These swellings may quickly subside, or end in either acute or chronic suppuration. In the latter case successive teeth being cut keep up the source of irritation.

Diarrhoea.—During the hot months of late summer and autumn, the irritation of teething may be the exciting cause of intestinal catarrh and diarrhoea. In infants a transference of a lesion from one part of the body, more especially from one mucous membrane to another, is exceedingly common; this diarrhoea is especially common in artificially fed infants. No diarrhoea should be attributed to tooth cutting, unless there is some local lesion in the gums or mouth.

Coughing.—During dentition, especially when the incisors are being cut, infants seem very prone to catarrh of the bronchial tubes, which may be complicated by catarrhal pneumonia.

Eczema and Lichen.—It constantly happens that infants who suffer, or are liable to suffer, from eczema are much worse while a tooth is passing through the gum. The eczema very frequently goes well in the intervals, the face and body being free, until a tooth comes near the surface, and there is a return of the eczema, the face and forehead flush up and papules appear which begin to ooze and crust. Lichen in the form of strophilus or urticaria is also common.

Convulsions.—It may be taken for granted that no healthy infants suffer from convulsions; those who do are either sickly or the children of septic parents, and inherit a tendency to nerve disturbance. Spasmodic affections of various groups of muscles occasionally take place.

Teething.—Much controversy has arisen from time to time with regard to the use of the gum lance, and the propriety of employing it in assisting dentition, many practitioners being in the frequent habit of using it, while others have not employed it for years. If the mucous membrane over the tooth is red, swollen, and tender, and the edge of the tooth can be felt, much

pain and discomfort will be spared the infant by its use, preserving, of course, it is not a "bleeder," nor comes of a family in which there is a history of hemophilia. The relief afforded is due in all probability to the local loss of blood, as well as to the relief of tension in the gum. That it has been done often unnecessarily, and that many troubles are attributed to dentition that have no connection with it, is no argument against the use of the lancet in proper cases. The evidence is too strong to be lightly explained away, that fits of crying, feverishness, or even convulsions may be quickly relieved by freely lancing a swollen and tender gum. It, perhaps, need not be said that it is useless to lance the gum unless there is evidence that the cutting edge of the tooth is near the surface, or disappointment will certainly follow. In one case coming under our notice, in which an upper incisor was lanced in a rickety child, the tooth was not cut till exactly a year after the operation. The feverishness and tenderness in the mouth and sleeplessness may be generally relieved by mercurial purges, leucoderms, or simple salives (F. 1 and 2). As much as five grains of borax may be given if the infant is very restless, or two or three grains of chloral hydrate, or a mixture containing two and a half grains of each in a teaspoonful of syrup. Puncturing a tender and swollen gum with a saturated solution of borate of sodium or glycerine and water will often relieve pain. If the gums remain spongy, or there is aphthous stomatitis, borax with lact. troych may be used (F. 3).

The temporary teeth differ in size and hardness in different children, in weakly rickety children they are not only late in appearing, but when they do appear are dwarfed and consist of very shells, quickly becoming black and carious, or loose and falling out of their sockets. In other children the enamel appears deficient, and caries occurs early. Good care should always be exercised in the preservation of the first set of teeth. A soft tooth brush should be used every night, and the mouth thoroughly cleansed with warm water, in order to dislodge the fragments of food which have collected between the teeth. If the teeth show signs of caries, it is a good plan to use the tooth brush after every meal, mixing a few drops of an alkaline mixture with the water (see *Antiseptic*, *Antacid*, *St.* 34). Whenever it is possible, carious temporary molars should be properly filled.

The **second dentition** is not accompanied by the same troubles as the first, or at any rate to the same degree. The first molars and incisors usually make their appearance untroubled, and rarely occasion any inconvenience. The second molars may give more trouble. It sometimes happens that the gums get into an unhealthy state, being spongy and bleeding readily, while the teeth become loose and give pain during mastication. It is during this period that diarrhoea sometimes may be present. Gumbolts may be another source of trouble. If it is of importance to attend to the cleansing of the mouth during early childhood, it is of still greater importance to do so when the permanent teeth are appearing, and no effort should be spared to prevent their premature decay.

The structure of the permanent teeth is no doubt influenced by the state of the health during infancy. We have already referred to the fact (p. 13), that illness taking place during the first year of life may affect the permanent set of incisors, canines and first molars, while the bicuspids and last two molars escape. Mr. Hutchinson long ago pointed out that

congenital syphilis often gives rise to a peculiar formation of the incisors of the permanent set. The 'test teeth' for syphilis are the upper central incisors; the effect of this disease occurring during infancy is to arrest their development, causing dwarfing and also a central notch at the cutting edge, or perhaps a 'screw-driver' form of tooth; the other incisors may share in this want of development, but only in a secondary degree. Mr. Hutchinson has also pointed out that stomatitis occurring during infancy gives rise to a pitting or erosion of the enamel. The 'test tooth' for infantile stomatitis being the first molar, the incisors also may be affected, and they may be pitted by a 'transverse furrow' crossing all the teeth at the same level. In some cases the pitting of the upper surface of the molar produces well-marked rugosities (*depression or excavation*). Other deficiencies of the enamel of more or less extent have been described by French authors. Mr. Hutchinson believes that the stomatitis giving rise to this condition is often mercurial in its origin, mercury having been given in the form of 'teething powders' or in other ways. Mr. Moon used to speak of a 'mercurio-syphilitic' tooth in which there was a want of enamel over a semi-lunar space near the cutting edge, and in consequence a breaking down of the enamel over this area. M. Magist attributes erosion of the tooth to the effects of infantile convulsions, but it is probable the convulsions are coincident only.

It is by no means always easy to explain why some children have good teeth with perfect enamel, while in others the enamel is deficient and the teeth quickly become carious. There cannot be any doubt, however, that a strong and vigorous infancy and early childhood with a good digestion and careful feeding must favourably influence the development of the teeth; while infants who suffer from dyspepsia and are badly fed will suffer later on from bad teeth. No doubt apparent exceptions may occur.

Diseases of the Mouth

Catarrhal Stomatitis.—Catarrhal inflammation of the mouth may be primary, but it is more often secondary, accompanying dentition, dyspepsia, pneumonia, and other diseases. Stomatitis is especially apt to make its appearance during the first year of life, though it is common during the whole of childhood. Infants who are thus suffering, having begun to take the breast, suddenly let it go and cry, and are apt to stuff their fingers in their mouths; they are feverish and irritable, the saliva is increased in quantity, and the mouth feels hot if the finger be inserted; the salivary glands, especially the sublingual, are swollen and tender. On examination of the oral cavity, patches of intense redness are to be seen on the mucous membrane inside the cheek, on the gums, or hard palate, the tongue is generally bright red and clean, or the surface is covered with a thick creamy fur, the edges and tip being clean and red. This form of stomatitis is often called **Stomatitis erythematosa**. Very frequently at the seat of these erythematous patches, an exudation of yellowish or greyish secretion takes place, or there is a breach of surface where the epithelium is abraded, and small shallow ulcers are formed. These yellowish patches or ulcers are surrounded by a zone of redness. Such patches are usually termed **Aphthæ**, and when present the term '*aphthous stomatitis*' is often applied. Older children are

subject to these attacks, and it is often seen to affect a whole household at the same time, the adults by no means always escaping. It is uncertain if it is contagious, but it is certainly epidemic; it is sometimes associated with scurvy. There may be feverishness, the temperature rising to 101° accompanied by the appearance of vesicles on the mucous membrane of the lips, tongue, and soft palate; the vesicles soon disappear, being followed by patches of yellow exudation, or a shallow ulcer may remain. The spots remain sore for several days. Similar attacks have been described as occurring both in infants and children from drinking the unboiled milk of cows suffering from 'foal and mouth' disease; and in any case where these affections occur in a widespread epidemic it is well to make careful inquiry into this as a possible cause.

It is probable there are several distinct diseases resulting from specific micro-organisms included under the term 'aphthous stomatitis.'

Frankel has found par cocci, such as *Staph. pyog. citreus* and *albus*, as well as 'gas-forming bacilli' in stomatitis.

During attacks of measles, scarlet fever, measles &c. aphthæ often make their appearance on the tongue and inside the lips, while the corners of the mouth become excoriated.

In infants, aphthous patches, two in number, situated on the hard palate, one on each side of the median raphe, near the junction of the hard and soft palate, are often seen; these are round superficial ulcers $\frac{1}{4}$ in. in diameter, their base being of a yellowish colour and surrounded by erythema. They have been described as Beddard's aphthæ, or plaques gérygostomiques by Parrot. They are produced by the pressure of the back of the tongue against the hard palate in sucking. They have nothing to do with syphilis.

The treatment must depend upon the cause, whether the stomatitis depends upon dentition, gastro-intestinal catarrh, or other pathological condition. In most cases a mild purge will be useful to expel any indigestible food present in the alimentary canal, to be followed by one or two grains doses of chloride of potash in a little glycerine and water (F. 4).

Locally the spots may be touched with a solution of permanganate of potash (5 grs. to the oz.) or boracic acid (15 grs. to the oz.). If the spots are slow in breaking, they may be touched with lapis divinus. This latter consists of equal parts of sulphate of copper, alum, and saltpetre fused together. The diet should consist of milk and barley water made more dilute than usual, and for older children milk and soup. Beef tea and saline fluids are generally objected to on account of causing smarting in the mouth.

Parasitic Stomatitis. Thrush.—This form of stomatitis differs essentially from the forms already described, as it is due to the presence and growth in the epithelium of the mouth of a species of cryptogam (*Oidium albicans*). It is especially common in newly born infants and in those of a few months old, who are suffering from some form of wasting disease, and in whom the mucous membrane of the mouth is in an unhealthy condition. But it is also found in infants during the last half of the first year, less commonly during the second and later years. It appears as small white distinctly raised points or scattered patches on the soft palate, mucous membrane of the cheeks, lips, and tongue. While its chief seat is the mouth, it has been found in the larynx, œsophagus, stomach, cæcum, and in one or two instances in the lungs.

If marked with a small paint brush, the patch is found to adhere firmly to the mucous membrane and cannot be detached as can milk flocculi, for which it may readily be mistaken; if forcibly detached there is left a red surface devoid of epithelium. The mucous membrane of the mouth is often red and unhealthy around the patches, in other cases it is quite normal. In mild cases these white patches are small and few in number; in severe cases they become confluent and large, and the surface of the tongue and cheeks is covered with them. Infants so affected are mostly weak and ill, and often suffer from diarrhoea or gastric catarrh with wasting. It occurs in older children in the last days of tuberculosis, tubercular meningitis, typhoid, and pneumonia.

If a piece of the white patch be detached and examined microscopically, it will be found to consist of epithelial cells, bacteria, yeast fungi, and the thread-like filaments of various mould fungi. The identity of the fungus which gives rise to the disease is a matter of uncertainty, the difficulty of identifying it being largely due to the presence of various organisms in the white patches. It has been identified as the *Oidium lactis*, the mould fungus which is present in sour milk; the cultivation of Grunitz led him to believe it to be identical with the yeast fungi or wine ferment (*Saccharomyces mycelioides*). Rees, who further investigated it, believes it to be a yeast fungus, though not identical with the above; he gave it the name of *Saccharomyces albicans*. The micro-organisms of thrush is most probably, as Fraenkel states, a link between the yeast fungi (*Saccharomyces*) and the mould or thread fungi (*Hypomyces*). It can be cultivated in syrup, gelatine, or potatoes and bread paste; under certain conditions of nutrition it appears to resemble the yeast fungi, as on the surface of the gelatine; while at the bottom of the test-tube cultures it appears more like the thread-like forms of the mould fungi. It is aerobic, and does not liquefy gelatine.



FIG. 10. Fungus of thrush (*O. lactis*)
(After Chastelant.)

Platz believes it to be identical with a fungus growing on sweet fruits and nutmeg wood (*Monilia canicola*).

The fungus usually appears in the form of filaments made up of cells joined together 3-4 μ broad and 30-60 μ long; these branch in various directions; oval cells bud out from the joint between the elongated cells; spores are present in these roundish cells. (See fig. 10.)

Treatment.—It is of much importance that great care should be taken to cleanse the mouth after the infant has taken the bottle, especially in a weakly infant of low vitality, weak alkaline solutions, just tinged with Condy's Fluid, being useful for this purpose. This can be done with a large paint brush or soft wet rag, and on the first symptoms of thrush the borax lotion (F. 3) or similar solution should be used. As a stronger application to the parasitic

punches a solution of sulphate of copper (2 grs. to the ℥i or carbolic acid (2 grs. to the ℥i) is very effective when applied with a paint brush. The success of the treatment depends not only on the destruction of the fungus, but also on an improvement in the child's general health.

Ulcerative Stomatitis.—This form mostly occurs during dentition, and is perhaps most common during the period of the second dentition, or from the age of five to ten years. The children who suffer from it in the severe form are unhealthy, and are either recovering from some infectious disease, or have been badly fed, or have been exposed to unhealthy surroundings; it is also common in tuberculous children. A very similar condition is produced by scurvy tickets, and by chronic mercury or phosphorus poisoning. The first symptoms consist in increased salivation, the gums become pale, swollen, and spongy, and the breath foul; the salivary glands are swollen and painful, and there is often much swelling of one or other lip. The spongy gums bleed, and the blood, together with the mucus taken as food, decompose, giving rise to a very foul condition of the breath. The first part of the gums to be affected, is usually that round the incisors or eye teeth of the lower jaw; the first part of the gums suffers more than the back. The gums sometimes swell so as to partly cover up the teeth, irregular ulcers form on the swollen gums, which, as they increase, expose the roots of the teeth; the latter become loose and perhaps fall out. The ulceration is at first confined to the gums, but may involve the sulcus between the gum and cheek, and also the mucous membrane lining the cheek or the inside of the lower lip. In mild cases the symptoms are much less severe than this.

Necrosis of the jaw is apt to follow in some of the more severe cases of ulcerative stomatitis; instead of the process ceasing, as it usually does, the mischief spreads and a chronic osteomyelitis of the jaw is set up, much intensely fetid discharge comes away, the child's health suffers, the cheeks become puffy and flabby, the ulceration of the gums spreads, and after a while it is found that a large piece of jaw, carrying perhaps two or three teeth, is loose; this is taken away, and in some instances the process stops; often, however, any new bone that may have formed becomes infiltrated with the foul discharges, and the mischief spreads along the jaw, piece after piece is taken away, until at last the entire jaw may have to be removed. We have removed the whole bone from condyle to condyle for this condition. Many surgeons believe that the disease begins as a periostitis and not as an ulceration of the gums, and that alveolar abscess is the starting point: this is so sometimes, though we think certainly not always.

The child's health materially suffers from the discharge and foul state of the mouth. In one instance, after removal of the jaw, the child was sent home convalescent, but died suddenly, apparently from falling back of the tongue. Restoration of the jaw is very imperfect in these cases, for the new bone accretes as fast as it forms. The process closely resembles phosphorus necrosis, but it is not due to that poison.

Treatment.—After every meal the mouth should be well rinsed with warm water or Condy's Fluid, and the gums and teeth cleaned with a bit of absorbent wool or soft rag, wet sponge, so that the same bit may never be

Dr. Angel Money has reported a case coming on after typhoid and affecting the upper jaw. The lower jaw is the one most commonly attacked.

used again; the gums should then be stopped over with the glysterine of borax 2 parts to mixture of starch 1 part. Of internal remedies, by far the most efficient is chloride of potash, given in five or six grain doses three times a day. The diet should consist of fluids and soup, beef tea and other nourishing liquids being given freely, especially in those cases where the disease occurs in the poorly nourished and underfed. This treatment will usually suffice to arrest the disease; but once the bone becomes seriously involved, in some cases nothing seems to have any effect. Strong nitric acid, carbolic acid &c. seem to have little power, and the purulent infiltration only ceases when the whole bone has been destroyed. These plans should, however, be carefully tried, chloroform being of course given, and subsequently there should be very frequent cleansing of the mouth with equal parts of rectified spirit and water. As soon as the disease has ceased to spread, any loss of bone or teeth should be supplied by a plate with artificial teeth, to prevent falling in of the lips and the prematurely senile appearance thus produced. Even where the alveolus alone is destroyed, since no new formation of bone occurs the permanent teeth are often loosened and fall out.

Alveolar Abscess is, as might be expected, a very common result of the neglect or mismanagement of carious teeth. After an attack of toothache the pain may completely subside, and swelling of the face over either the upper or lower jaw rapidly come on. This, of course, means that the inflammatory process—hitherto limited to the alveolus, and hence giving rise to great pain, because there is great tension on a large nerve—has extended to the soft parts covering the bone by escape of the pus from the alveolus. The pain is greatly lessened, or ceases altogether. The condition is thought of little importance, and no steps are taken to obtain advice, as there is no longer pain, and a swelled face is looked upon as the natural and proper ending of a toothache. No doubt most of these cases get perfectly well at last for a time, for the abscess bursts either by the side of the tooth or more often through the alveolus and gum, and discharges itself into the mouth. Finally, the abscess closes up, and all remains quiet till some future bout of toothache or some irritation causes the carious tooth to another outbreak. In not a few cases, however, neglect to remove the source of irritation—i.e. the carious tooth—gives rise to one or other of the following troubles. Often a sinus remains inside the mouth leading through the alveolus to the fang of the dead tooth, and a constant discharge of a small quantity of foul pus takes place within the mouth. Such a condition cannot but be prejudicial to a child's health. The breath is foul, and the foul food is swallowed, poisoning like the lungs and stomach, and often a child is kept ailing for months, for want of extraction of a carious tooth. In other cases, the abscess tracks to the surface and is allowed to burst there, giving rise often to a lifelong disfigurement, in the shape of a depressed scar over upper or lower jaw. Or, again, a chain of enlarged lymphatic glands or a glandular abscess owe their origin to neglect of a carious tooth or alveolar abscess. Necrosis of the jaw often results from similar neglect. Occasionally, too, we see cases of *asial abscess* in children as a result of extension of mischief from a tooth, though it is perhaps less common in children than we might expect. There is a most unreasonable objection both on the part of

pusulas and of some dentists to extraction of teeth, even if they are extensively carious, and even if they are only temporary teeth. It is difficult to believe that the retention of a dead or carious temporary tooth can do anything but harm to the jaw and the underlying permanent teeth. It is perhaps still more difficult to understand the principle on which objection is made to the removal of a tooth while there is an abscess present, yet it is constantly done, and delay is urged till the abscess is well. In all cases a carious temporary tooth should be removed at the least sign of inflammation about it or if it causes foul breath. In all cases a tooth that has given rise to an alveolar abscess should be removed, and if its extraction does not empty the abscess a free opening should be made inside the mouth, and the abscess cavity and whole mouth frequently washed out with some antiseptic lotion till all is well again. On no account should an abscess be allowed to track towards the surface of the face, nor should any tooth be allowed to remain in the jaw with a sinus leading down to its fang. If an alveolar abscess is met with in necrosis of the jaw, they must be dealt with by the ordinary methods, bearing in mind the softness and thinness of children's bones. We have now (1897) under our care a child with extensive ulcerative disease of both jaws, which probably arose from the irritation of carious teeth.

Cancerum Oris.—Cancerum oris occurs almost invariably in squallid, half-starved children after one of the exanthemata; sometimes, however, it seems to have no such predisposing cause. The disease begins as an inflamed spot on the inner surface of the cheek or upon the gum, the mischief rapidly spreads, both in depth and area, and the whole thickness of the cheek and gum becomes involved. On the outer surface the cheek is swollen, shining, stiff, and pale, or sometimes dark red, its vessels are thrombosed, and soon a black spot appears in the centre of the pale waxy area; the cheek is perforated, the black spot becomes a definite slough which partially separates. Then the edges of the gap become black and the sloughing spreads, preceded by a zone in which the skin is pale and oedematous. In severe cases the whole side of the face is rapidly destroyed, the gums slough away, the jaw necroses, and the teeth drop out. There is intense fever of the discharge and tooth, which poisons the child, frequently causing prostration and death before the process is complete. Dr. Wilks considers that when the sloughing attacks the gum first it may be only an aggravated form of the ulceration met with in a late condition of scarlet fever; this is very usually in the lower jaw, while in true cancerum oris the upper jaw is attacked.¹

Sanson has described an organism which he found in the blood and diseased tissues. When taken from the blood and inoculated into guinea pigs and mice, it was found again in their blood.² In a fair number of instances the process is arrested and the sloughing ceases, the parts clean up and heal rapidly, leaving, of course, a more or less severe deformity. In fatal cases death is due to exhaustion or septic pneumonia. The amount of pain and distress suffered is variable, sometimes but little of either exists.

Treatment.—The treatment of cancerum oris consists in the free local application of the actual cautery, or, better, of pure nitric acid. The child

¹ An excellent description and figure are given in Mr. Cooper Ferguson's book on the *Surgical Diseases of Children*.

² *Med. Chir. Trans.* 1894.

should be put under chloroform and the parts carefully dried with lint. Slices dipped in strong nitric acid should then be rubbed well into the edges of the sloughing parts and over the surface of the gums, after cutting away any loose sloughs and removing sequestra. Care must, of course, be taken not to allow the acid to run over the sound skin. Several applications of the acid should be made, the parts being dried after each. Afterwards, a little iodoform should be powdered on and the surface smeared well with castor-oil. E. C. Kingsford has had good results from the application of perchloride of mercury, but it has not proved universally successful. No less important than the local treatment is the free administration of stimulants and abundant nourishment.

As much wine or brandy as the child will take (about 3-4 ounces of brandy is twenty-four drops for a child of five years), carbonate of ammonia and bark, eggs beaten up with milk, strong soup and meat-extracts should be given. In these cases, as in phlegmonous erysipelas, patients seem to be able to take almost an unlimited amount and to thrive upon it. Opium should be given, but with caution, as it is not always well borne. If the child recovers, the deformity is often remediable to a considerable extent by a plastic operation. Perhaps the most troublesome after condition is closure of the mouth by adhesions; an attempt to prevent this should be made during healing by the use of screw gags or mouth-openers, and later, by division of the scar tissue; in some cases even section of the jaw and the establishment of a false joint may be required. It must be confessed, however, that the treatment of this cicatricial contraction is far from satisfactory, and often no permanent good result is obtained.

Some cases of cervical cellulitis (so-called *angina Ludovici*) closely resemble cancerous abscess in their results. (*Other Diseases of Lymph Glands.*)

Acute Tonsillitis.—It is hardly possible to exaggerate the importance of a thorough examination of the throat of a febrile child, especially when the cause of its illness is not obvious. A child, more particularly a young one, does not, like an adult, volunteer the information that its throat is sore and painful during the act of swallowing, and will even deny that it is sore when it is actually suffering from severe tonsillitis. Without a careful examination it is quite possible to overlook not only tonsillitis but scarlet fever or diphtheria, especially if there is some chest-complication present to throw the observer off his guard; or he may come to the conclusion that a case of submaxillary "swings," or croupous pneumonia with physical signs delayed,



Fig. 11.—Indurated swelling after recovery from cancer abscess; subsequently remedied by a plastic operation. (Dr. Williams's case.)

is a case of scarlet fever. Anyone who has had any experience of a fever hospital will be able to call to mind many cases where errors have been made through neglecting to examine the tonsils or from want of knowledge of their appearance in health and disease.

Children are very liable to tonsillitis in its broadest sense; and this is in harmony with the fact that the lymphatic system during childhood is extremely active and especially prone to inflammation. The use which the tonsils fulfil is uncertain, but, whatever their exact function, it is certain that they belong to the lymphatic system, and they have been justly compared to Peyer's patches, inasmuch as they resemble them in structure, consisting of conglomerates of lymph follicles or so-called 'solitary glands.' They have a large blood supply and their lymph sinuses freely communicate with the lymphatics of the mouth and pharynx, and also with the deep



Fig. 10.—Vertical section of human tonsil (see text). London and Walling, A. 1877. 1, epithelium infiltrated with leucocytes; below and on the left, but less on the right; 2, almost closed with sections of masses of (1); 3, follicle; 4, follicle; 5, section of tonsillar gland duct; 6, blood vessel.

cervical glands situated behind the angle of the jaw. Their surfaces are covered with deep clefts or crypts which serve to increase the surface of the mucous membrane covering them; these are apt to become filled with thick yellowish secretion, and are then seen as yellow points scattered over the surface. One of the functions of the tonsils is probably the formation of leucocytes, or white blood corpuscles, which are shed into the salivary secretion, and the cheesy secretion formed during inflammation consists principally of these bodies. Tonsillitis occurs under the influence of many different conditions during childhood, and possibly the progress of the tonsillar inflammation is, in part at any rate, the result of their position at the entrance of the fauces, where the various forms of aerial poisons, bacilli or other germs, would, when inhaled, be especially prone to lodge. Many of the systemic diseases are accompanied, or, what is a very significant fact, are preceded,

by tonsillitis. Thus the tonsils are the seat of inflammation in scarlet fever and diphtheria. Typhoid fever sometimes commences with a sore throat, measles and rubella are mostly attended with some congestion or catarrhal inflammation about the fauces. The tonsils are apt to become inflamed as the result of cold, as from a wetting or exposure to a draught or keen east wind, and possibly also from some gastric disturbance. There can be little doubt also that tonsillitis is at times due to inhaling sewer gas or unwholesome smells. It also appears sometimes to precede or accompany an attack of acute rheumatism, or pericarditis.

The record of tonsillar complication is not complete without reference to the epidemics of sore throats which are apt to occur in schools, hospitals, and other public institutions, or wherever many children are brought



FIG. 11.—Acute Tonsillitis. a, child aged three years; b, child aged 4 years. These two cases belonged to an epidemic of sore throat; child's fever was not completely excluded, but in no case was there a rash.

together. Some of these epidemics have appeared to be modified scarlet fever or diphtheria, as proved by their belonging to a scarlatinal or diphtheritic epidemic which was concurrent in the neighbourhood or preceded or followed the epidemic of sore throats. But in other cases it has been clearly shown that there is an epidemic or infectious form of sore throat which closely resembles both scarlet fever and diphtheria, but which, while similar in many respects, is actually distinct, as shown by its not protecting from either of the above diseases.¹ Some cases of epidemic sore throat have apparently been traced to the consumption of the milk of cows suffering from 'foot and mouth' disease. Whenever sore throats occur in a household or school, the possibility that they are the result of the scarlatinal or diphtheritic poisons should always be kept in view, while at the same time the milk

¹ *Acute Tonsillitis in Adolescents*, by C. HUGHES, M.D.

supply and the sanitary condition of the establishment should be carefully investigated.

To whatever cause the tonsillitis is due, whether specific or epidemic, the symptoms are mostly the same. The attack usually begins suddenly, though it is often preceded for a few hours by a feeling of soreness in swallowing. Unlike scarlet fever, it is usually unaccompanied by vomiting; the evening temperature runs up to 105° or more, the tonsils are swollen and red, there is much secretion of mucus, and in a few hours yellow points make their appearance upon the tonsils, the result of secretion retained in the crypts. (See Fig. 12.) The tongue is furred, but does not become of a 'strawberry' appearance as in scarlet fever. In some cases, instead of the yellow points seen on the tonsils there is a yellowish exudation formed by the coalescence of the yellow spots on the inner surfaces of the tonsils; this does not adhere, as a rule, with any degree of firmness, and may be removed with a brush. The inflammatory lesion remains for the most part local, and shows but little tendency to spread and involve the nasal mucous membrane or the middle ear, and, while the glands of the angle of the jaw may become enlarged, they are not hard or surrounded by cellulitis. There is no true ulceration of the tonsils or sloughing of the palate. The temperature remains constant for a few days, gradually returning to normal.

Such is the clinical history of an attack of acute catarrhal tonsillitis, but it must be remembered that many such attacks are exceedingly mild and are accompanied by but little pyrexia, and may perhaps come and go without much complaint being made about them. Acute tonsillitis from any cause is apt to leave the tonsils enlarged, and the mucous membrane covering them in a condition of chronic catarrh. Repeated attacks in children liable to glandular swellings, accompanied as they are by catarrh of the naso-pharynx in many cases, give rise to various troubles which will be described later on.

Diagnosis.—The most important question to consider, when called to see a case of tonsillitis, is whether scarlet fever and diphtheria may be excluded with certainty; as, if they can, it is tolerably certain that the case is not one which will give rise to any anxiety either on account of the patient himself or his friends. Unfortunately, however, it is not often possible to express an opinion without hesitations; that which appears to be a simple tonsillitis may be scarlatinal or diphtheritic in origin. It need hardly be said that the child suffering from tonsillitis should be stripped and a careful examination made of the surface of the body by a good light in order to detect a rash, and the faintest rash would necessarily arouse suspicion. In the absence of a rash a certain diagnosis is often impossible, but glandular enlargement, discharge from the nose, much yellow exudation on the tonsils, true ulceration of the tonsils or soft palate or uvula, if present, would make the diagnosis of scarlet fever a probable one. Should desquamation follow, if it is certain there has been no rash, it is of no diagnostic importance. If nephritis occur in the third week, it points to the scarlatinal nature of the attack as beyond doubt. A strawberry tongue is rarely present in the absence of a rash. The difficulty of diagnosis between mild diphtheria and tonsillitis accompanied by greyish exudation is hardly less than that between tonsillitis and scarlet fever in the absence of a rash. Albuminuria, nasal

discharge, glandular enlargement and cellulitis, and the presence of Loeffler's bacillus in the exudation, all point to diphtheria; if paralysis follow, the diagnosis of diphtheria is certain. (See DIPHTHERIA.)

Treatment.—Every attack of tonsillitis during childhood should be treated not only with respect but with suspicion, and the case should at once be isolated so far as it is possible to do so. It should constantly be before the mind of the practitioner that the case may be one of abortive scarlet fever or diphtheria, and that the worst case to which he is called in the same household may be a genuine attack of one of the above zymotic diseases. It is always wise, when called to such cases, to give a guarded diagnosis and prognosis until the case has been under observation for a few days. The patient is to be confined to his room or to his bed, according to the severity of the attack, and his diet should consist of milk, beef tea, and soup. If there is much pain in swallowing, hot fomentations indicated with belladonna or opium may be applied externally and renewed at frequent intervals. The tonsils should be painted with a solution of boroglyceride in water (i-12), or iodine gr.ij, glycerine 5j, and water ʒj; black currant jelly or lozenges are also useful. Salines, such as the citrates or chlorates of the alkalies, combined with acetate or salicylate of soda, if there is much fever, may be given during the febrile stage; acids and emetics during convalescence.

Chronic Tonsillitis.—So-called chronic tonsillitis, or tonsillar hypertrophy, is a very important child's disease, though by no means limited to childhood. The affection consists in an actual overgrowth of the tonsillar adenoid tissue, so that the tonsils become greatly enlarged and project as rounded or irregular masses in various directions. Most commonly they grow inwards towards the middle line, and may reach such a size as to gape and be flattened by manual pressure; they may then almost completely block the width of the pharynx. In other instances they enlarge vertically and become large oval masses, projecting far down into the pharynx and upwards and backwards towards the posterior naris. In other cases again they protrude outwards, separating the layers of the soft palate and forming a bulging mass on the roof of the mouth. Sometimes the surface is almost smooth, marked only by the orifices of the tonsillar crypts, and sometimes it is quite rugged and irregular.

The overgrowth is often accompanied by recurrent attacks of acute inflammation, in other cases there is no pain or acute distress at any time. The secretion of the mucous glands may be retained, and thick pellets of inspissated matter be shut up in the crypts. Occasionally, on examining the region of the tonsil, instead of the usual appearance, a large yellow mass will be seen blocking up the whole of that side of the pharynx: it is soft and fluctuating, and an incision gives exit to a large quantity of thick *effluvia* of mucus, pus, cholesterine, &c. This condition we have sometimes thought to be a congenital mucoid cyst. It is rather alarming at first sight, and looks like a large abscess on the point of bursting. The symptoms are those of tonsillar hypertrophy with more or less dysphagia.¹

¹ The causes of tonsillar hypertrophy are obscure; it has been supposed to be the result of irritation of neighbouring parts passing on by continuity, as in other parts of the lymphatic apparatus, or some cases possibly connected with one of the exanthems, as

The ordinary enlarged tonsil is usually pale, and in old cases hard and sometimes almost cartilaginous. The enlargement may be found at any age from birth (being sometimes congenital) to puberty, or more rarely later; it gives rise to a definite series of symptoms, all or most of which are usually present together. There is a vacuous, heavy look, from obstruction to breathing and consequent imperfect aeration of the blood, also imperfect development, and often stunting of growth: the mouth is kept open, the breathing is stertorous and in sleep snoring. These children usually sleep heavily but restlessly, often starting in their sleep. Incontinence of urine is sometimes present, a result, no doubt, of the supply of imperfectly aminated blood to the nervous centres. There is usually chronic nasal and often nasal catarrh, from the extension of irritation from the tonsils to the neighbouring mucous surfaces. The speech is nasal and indistinct, the chest is often ill-developed, pigeon-breasted, or, as pointed out by Landron, has the diaphragmatic constriction (M. Mackenzie). Recurrent acute tonsillitis is generally complained of, but there is seldom constant dysphagia; there is an increase of the pharyngeal mucus due to catarrh, and the breath is often foul. The actual breathing and stunting from this condition is sometimes very marked. We have seen a difference of several months' growth in twins, one of whom had enlarged tonsils, the lost ground being rapidly regained after removal of the glands.

It is in our experience true that enlargement of the tonsils is nearly always accompanied by the presence of the closely allied adenoid vegetation in the naso-pharynx, to be mentioned presently. Occasionally, however, either may exist without the other. The lingual tonsil appears to be much less often affected, or at any rate it very seldom gives rise to any symptoms. We think it is more common to find adenoid growths without enlargement of the tonsils than hypertrophic tonsils without adenoids.

Treatment.—Chronic tonsillar hypertrophy, when well established, is little affected by mere local applications or constitutional treatment; it is only during an attack of acute inflammation that good can be done by such means. In the early stages of the affection astringents, such as glycerine of tannin, and trunks sometimes succeed. The only efficient mode of treatment is by removal; caustics and the actual cautery are inferior methods of obtaining the same result.

For that form of enlargement in which the tonsils project upwards, or upwards and forwards, nothing is so efficient, simple, or easy as removal with the guillotine.¹ Chloroform should be given if the child will not allow removal otherwise: there is no objection to it except that it makes the operation somewhat more troublesome.

As much tonsil as can readily be removed should be taken away, but it is not necessary to remove the whole gland, the part left behind usually soon shrinks. Both tonsils, if enlarged, should, if possible, be removed at one sitting.

The guillotine cannot be satisfactorily used unless the tonsils project considerably, perhaps the result of the destruction of the tonsillar mucous glands; or, as some would think, it may be a result of the overfed squamous epithelium.

¹ Fildesock's is the one that we prefer, though it is a somewhat expensive instrument and liable to get out of order; those merely sold are too large and clumsy for convenience.

siderably towards the middle line; in many cases, however, it may be made easier by pressing the tonsil inwards with the finger applied to the neck just in front of and below the angle of the jaw.¹ Where the overgrowth is outwards and the gullotine cannot grasp the tonsil, the vulsellum and guarded blunt-pointed caustery must be used, care being taken to keep the edge of the knife turned somewhat inwards. In some few cases even this is impracticable, and it is only in these rare instances that puncture with the Paget's caustery should be employed; the caustery may be thrust through the anterior pillar of the fauces, or directly into the gland between the pillars at one or two points; shrinking is said to usually follow. Potassium fusa is sometimes used, but is dangerous and tedious; scraping away the tonsils with a sharp spoon is the best plan if the gland is very friable and soft.

Removal of enlarged tonsils while acutely inflamed is usually condemned. We have, however, done it with great relief to the patient; it is, of course, much more painful for a few minutes.

After removal some swelling often follows, and may last for a week or so, but soon subsides. After free removal the enlargement rarely recurs. We have, however, seen two or three instances where a re-growth, larger even than the original one, has appeared after a lapse of some months. We should be inclined to look with suspicion upon such cases as possibly indicating a tendency to lymphomatous growth elsewhere.

We have enucleated a tonsil with the gullotine on two or three occasions, the whole gland coming away entire instead of being cut through; the result was, of course, satisfactory. It has recently been proposed to revive this old method of enucleation, but we think in the majority of cases it will not be found practicable.

After the operation, food only should be allowed for the first day, and milk and soft food for the next day or two; after this the ordinary diet may be gradually resumed. Painting the tonsils with glycerine of tannin after the operation is perhaps useful.

We have never seen bleeding follow the operation to any serious extent; when it does occur it usually arises from injury to the pillars of the fauces, which are sometimes stretched over the tonsil so tightly as to be indistinct. A little ice or suck is all that is needed in most cases; should there be any severe bleeding, pressure or the application of the caustery, or perchloride of iron, might be required. Injury to the carotid is, of course, out of the question.

The argument against the excision of tonsils, that the overgrowth subsides as the child grows up, is altogether invalid in any severe case, for the mischief to the general development, and often to the hearing power, is done before the tonsils subside. There is no foundation for the idea that any wasting of the testes occurs from removal of the tonsils; it is much more likely that a lack of development would be due to the nodular enlargement than the reverse. The operation is an altogether harmless and beneficial one.

Tonsillar Calculus is a very rare condition, due to collection of secretion or inflammatory material and subsequent calcareous degeneration: the tonsil

¹ The tonsil cannot be felt externally, but a lymphatic gland lies just on the outer side, and when enlarged is often mistaken for the tonsil (Tymek).

is enlarged, hard, and often painful, the calculus can be felt by a probe, and should be turned out of its cavity.

For the connection of tonsillitis with adenitis, the reader is referred to the chapter on Diseases of the Lymphatic Glands.

Enlarged Uvula.—The uvula is sometimes acutely inflamed as part of a pharyngitis or chronically enlarged; in the latter case it may require to be stripped off. We have also met with a case of papilloma of the uvula.

Nasal Adenoid Growths.—It often happens that a child is brought with all the symptoms of nasal hypertrophy—chronic nasal catarrh, pinched nose, nasal obstruction, snoring, nasal voice, deafness, impidity, &c.—(see Chronic Tonsillitis) and yet the tonsils are little if at all enlarged, or if they are their removal does not cure the affection. In such cases there is probably overgrowth of the post-nasal adenoid tissue, the "*pharyngeal tonsil*," or "*adenoid tissue*," as called. This condition, which was first described by Meyer, is very common in childhood and is often overlooked; it is, however, readily found out and treated if its symptoms are contemplated.

A finger passed back into the pharynx and turned up behind the soft palate to the posterior nares will feel warty, bumpy, or perforated masses about the upper surface of the soft palate and round the posterior nares, often almost completely blocking the apertures.

These excrescences bleed readily, but are not tender to the touch. In such cases, snipping the masses away with a Volkmann's spoon passed through the anterior nares and guided by a finger in the pharynx, is the best treatment. A Meyer's ring scraper or forceps may be employed if preferred, or Lowne's or Ferris' and Liston's scrapers will be found useful supplements to the sharp spoon; they are of course used through the mouth. It is far better in these cases to give chloroform and do the operation thoroughly than waste time, and hinder by incomplete scrapings with the finger nail or applications of the cautery or other such means. If done thoroughly by the method recommended, it is very rarely necessary to repeat the operation, though occasionally growths so small as to escape removal subsequently enlarge and require treatment. It is best to operate with the child's head thrown well back over the end of the table, so that jet blood trickles into the air passages. This operation is one that should be strongly insisted upon; it removes a source of many troubles and much weak health.

The affection is an exceedingly common one, and may be met with at all ages. We have seen it in quite the first few months of life, and we believe it is sometimes congenital. No treatment except mechanical removal is to be recommended, though the application of caustics may in some cases be effectual.

Pharyngitis Gangrenosa.—We have met with two cases of pharyngitis in which extensive ulceration occurred, and which did not appear to be due to diphtheria, scarlet fever, or other systemic disease. One of these cases was a lethargic healthy boy aged nine years, there was little fever, but much induration and cellulitis at the angle of the jaws. When seen by one of us, it was impossible even under chloroform to get a good view of the fauces; there were one or two smart hemorrhages from the mouth presumably from ulceration. He was apparently recovering when a sudden hemorrhage occurred, evidently from the throat, which proved fatal almost immediately: no post-mortem was

obtained. In the second case there were no haemorrhages, but a deep ulceration of the larynx and pharynx; the disease much resembled in its onset and course gangrenous stomatitis, and proved fatal.

Post-pharyngeal Abscess.—Abscess in the prevertebral fascia is usually either the result of caries of the cervical spine (see SPINAL DISEASE) or of suppuration of the lymphatic glands in this region from irritation about the pharynx or posterior nares. The symptoms are dysphagia and dyspnoea, with pain and dribbling of saliva or mucus; a peculiar nasal or palatal resonance in the cry is described by Politzer. On examination, a soft fluctuant swelling will be felt, and the posterior wall of the pharynx will be seen to project unduly, and possibly the yellowish colour of the pus may be seen through the mucous membrane. When the abscess is due to simple mucous irritation it should be opened through the mouth with a guarded knife, the child being turned on its face as soon as the incision is made, to allow the pus to flow out readily. We have seen post-pharyngeal inflammation give rise to so much dyspnoea without any visible pointing as to render tracheotomy necessary. Occasionally a large mucous cyst, such as that described as occurring in the foetus, will be found on the posterior wall of the pharynx; free incision is all that is required for these conditions. In other instances suppuration tracks round the outer side of the pharynx from the tonsil or soft palate or from suppurating cervical glands or other neighbouring parts. Where there is external evidence of abscess it is better to make the opening in the neck, so that the wound may be rendered aseptic, as in abscess from spinal disease. Other causes of post-pharyngeal abscess are injuries and pharyngitis; it may also occur in the course of scarlet fever or be the result of a breaking-down germ. Many cases are recorded by Holst as idiopathic; it is not impossible that some of these were glandular. Wiel gives otitis as a cause. Convulsions, facial paralysis, great swelling of the neck, and spasms of the sternomastoid may sometimes occur (M. Mackenzie). The disease has been mistaken for many different affections, probably most often for croup. Examination of the throat by the eye and finger will always clear up a doubt in the later stages, though, as already pointed out, the diagnosis may be very obscure at first.

We have met with these abscesses in quite young infants, as well as in older children. In the last case that we saw a finger passed into the abscess cavity could find its way between the vertebrae and the pharynx upwards nearly to the base of the skull, and downwards almost to the root of the neck. The abscess was probably the result of suppuration in a retro-pharyngeal lymphatic gland, and caused both dysphagia and dyspnoea.

Retro-pharyngeal abscess sometimes occurs, and may give rise to dyspnoea necessitating tracheotomy, rarely to dysphagia; it may be due to spinal caries or extension of suppuration from other parts.¹ It is not so common in children as the retro-pharyngeal abscess; when it occurs there is swelling on both sides of the neck, dryness of the throat, tenderness and pain on movement, with fever and alteration of the voice. The abscess may burst into the oesophagus or burrow round the neck. We have recently met with three cases of abscess bursting into the oesophagus: in two caries of the spine,

¹ Jakobson f. Kinderheilk. B. vii. H. v. 2.

² Eyles, *Index of Pediatrics*, Feb. 1886.

and in the other tuberculous gland disease was the cause of the abscess. According to Bartholin and Kiliot, a form of dry coryza, with even coma as complications, may occur, and the onset may be sudden. After the abscess has burst, 'stricture disenterica,' or stricture of the gut, may result. The prognosis is bad. Puncturations and feeding by esophagus or an oesophageal tube should be the only treatment, with incision at the posterior border of the sternomastoid as soon as there is distinct evidence of suppuration.

Stricture of Oesophagus.—Apart from congenital malformations, oesophageal stricture in children is due either to paralysis, or to cicatricial strictures, resulting usually from swallowing hot or corrosive liquids, such as gerani, hydrochloric acid, &c. In such cases there is immediate danger of suffocation from impaction of the larynx, as well as more or less dysphagia from pain and swelling. These troubles, however, may be slight and transient, and yet after a time cicatricial stricture may appear, or the obstruction may persist from the first.

In cicatricial strictures there is a good deal of muscular spasm present, either constantly or from time to time, and this may be much increased by the passage of bougies. In some cases it is impossible to pass even a small instrument without an anæsthetic, and yet a fair sized one may be admitted when the child is fully under chloroform. Sometimes at intervals the child is able to swallow fairly freely, while at other times the obstruction is almost complete. The profuse secretion of saliva and mucus is often very distressing. The most common seat of such contractions is high up in the gullet, but they may be very extensive. The position of the stricture may be ascertained by auscultation during drinking, or by the passage of bougies,¹ after the history of the accident and the dysphagia have led to the discovery of the obstruction. A careful examination should be made of the oesophagus, to find out if possible the calibre, position, and number of the strictures, but bougies must be used with the utmost gentleness. We have had a case of perforation of the oesophagus and escape of fluid into the pleura in our own experience. In a case which we saw with Mr. T. H. Pinder he told us that at one time marked improvement in power of swallowing followed entire deprivation of all food by mouth; the child was supported for some days entirely by enemata, and it is probable that absence of irritation caused relaxation of muscular spasm, though there was a possibility that the relief was due to a sloughing off of the edge of the constricting cicatrix at least in part, or it may have been simply that there was an interval in the progress of the contraction analogous to that occurring in cases of malignant disease. Mr. Pinder suggested that abstinence might also have diminished the size of the pouch which forms in these cases above the stricture, and so abolished the valve-like obstruction to some extent.

The best treatment of oesophageal stricture in such cases is usually still by gradual dilation with bougies.² The drawback to it is that relapse is very apt to occur as soon as the daily passage of the instrument is omitted. Forceful dilation by McGermac's dilator and internal oesophagotomy have

¹ In new-born children the distance from the gums to the cardiac orifice is about 10½ inches (Dr. Mosell Macdonald).

² Keller records thirty-four cases under two years of age with twenty-three cured, ten progressed to three cases, and five deaths, four remaining under treatment.

been employed; the former may be useful, the latter is too dangerous. Failing these, oesophagotomy may be performed if the stricture is limited to the upper part of the gullet, or if not, gastrostomy; the latter operation is the safer and the more generally applicable one. If an operation is to be done, it must not be put off too long. As soon as it is clear that dilataion is insufficient and the child is losing weight, no farther time should be wasted. Done early, and done in two stages (Howse), some success may be expected from gastrostomy, and the rest given to the gullet by the operation may result in restoration of the canal subsequently (Davies Colley), or it may be possible to dilate or divide the stricture by instruments passed upwards from the stomach into the oesophagus. For details of the operations we must refer to the general text-books. In a recent case in which we performed gastrostomy there was much trouble from regurgitation of the food through the gastric fundus. The wound became fatally, and the child died of abscess between the liver and stomach.

Oesophageal stricture from congenital syphilis, and obstruction from pressure of abscesses outside the gullet or from traction by costal tissue around (perioesophageal abscess), are occasionally met with, as in the following case, in which stricture of the oesophagus followed scarlet fever:

Hannah N. at three had scarlet fever six months before admission. The attack was a severe one, with a bad throat and suppurative of cervical glands. She was admitted April 2, 1864, with trismus of the oesophagus, severe enough to have prevented swallowing which he came some pain. Taking milk and gruel. The obstruction was at the level of the cricoid, and even the smallest finger could not be passed through it. The pharynx above the stricture was dilated, causing a protrusion on the left side of the neck. She was able to swallow milk and her age, and gained weight in hospital. She was taken out, and again admitted in the following October, when the symptoms, which had been better, became worse upon attempting to swallow some soup. There was then complete obstruction, but under chloroform a small catheter (No. 2, English) was passed through the stricture, which was apparently extended by a considerable distance. When turned of face some afterwards, she could not bread and butter and mashed potatoes very well, but could not get down meat. She was well nourished.

Swallowing Foreign Bodies.—It is very common for children to be brought with a history of having swallowed a farthing or button, or something of the kind, and much alarm is caused to the child and its friends. In many cases the history is a mistaken one, in others the foreign body passes into the stomach, gives rise to no symptoms, and is voided in a day or two with the motions.

The only treatment required in such cases is to give the child plenty of bread, gelatines, sweet pudding &c. to provide a sufficient fecal sheathing for the harmless passage of the body.

In some few instances, however, an angular mass such as a bone, or some sharp-pointed object as a pin, may be swallowed, and may be arrested in the pharynx or oesophagus. In such cases there is usually some obvious sign of its presence, such as pain, dysphagia, retching or vomiting; possibly some blood-stained mucus is brought up.

If there is no urgent dyspnoea, a careful examination of the fauces should first be made, to see if the object is not lodged between the pillars; failing this, the finger should be passed to the back of the throat, and the root of

the tongue and epiglottis be swollen, care being taken not to mistake the cornea of the larynx for a foreign body. If nothing is found, and the site of the body can be felt from the outside of the neck, and especially if the mass is hard, angular, and movable, an attempt should be made to remove it with the trisite pushing or corn sucker, or failing these, possibly with esophageal forceps, though these are more dangerous. Failing these plans, the choice lies between an attempt to push the foreign body on into the stomach and the performance of esophagotomy. The first plan should be followed in the majority of cases, and can be best managed by the gentle, steady use of a good-sized brogie. It is applicable to instances where the foreign body is soft, smooth, and rounded, and not likely to give rise to trouble in its passage through the intestines. It must be remembered that a feeling of soreness and irritation may remain about the forces for some time after the passage and removal of a foreign body, and may give rise to the belief that there is still something there. In cases of swallowing fish bones, and their becoming impacted, doses of hydrochloric acid or vinegar and water may be given, but the remedy is unpleasant and tedious. An anæsthetic may be used to lessen the discomfort of instrumentation. Emetics, as a rule, are not good treatment.

Esophagitis.—Infantile esophagitis, first described by Billard, is a rare disease, supposed to be caused by irritation from bad milk, improper feeding, or sore nipples. The symptoms are unwillingness to suck, crying and immediate regurgitation after beginning to suck, and often some tenderness about the neck on pressure. The inflammation may be local or general, and may give rise to ulcers or sloughing, and possibly to subsequent stricture. The prognosis is bad; the disease may come on immediately after, or even exist at birth. It is not likely to be mistaken for anything except congenital malformation, in which the obstruction is absolute. Cleanliness, careful feeding, and the administration of glysterie of lemon in small doses, constitute the treatment.¹

Other rare conditions met with are congenital hypertrophy of the mucous glands and varts of the esophagus.

¹ See Hand-Book.

CHAPTER V

DISEASES OF THE DIGESTIVE SYSTEM *(continued)*

Examination of the Abdomen.—*Inspection.*—The abdomen in infancy is proportionately larger and is usually more distended than the abdomen of adults, and this is at once apparent on inspection as the infant lies stripped in its cot or on its mother's lap. An exaggeration of this condition is often seen in cases of chronic dyspepsia or intestinal catarrh; there is great distension of the intestines with 'bound wind,' the abdomen being much increased in girth and the skin stretched and shiny. If, as is often the case, there is more or less wasting of the fatty tissues, the large abdomen contrasts strongly with the wasted and shrunken form of the infant, giving it a very characteristic appearance. The large liver of the infant is responsible in some extent for the disproportionate size of the abdomen. An inspection of the abdomen will reveal any enlarged cords on the surface, or the presence of large tumours or an excessive amount of fluid in the peritoneum. The umbilicus will be examined at the same time, and any hernia or local lesion here detected. Instead of a distended abdomen, the condition of flatness or retraction may be present, especially if there is acute cerebral disease.

Palpation.—The muscular wall of the abdomen is comparatively thin, and less rigid in infants and young children than it is in adults, and consequently palpation yields more certain results, and is of greater value as a means of diagnosis in the former than in the latter. Thus in young children the edge of the liver, an enlarged spleen or kidney, feces in the colon, a distended bladder, a mistral and thickened omentum, and even enlarged mesenteric glands may be felt by more or less deep pressure by the hand on the abdomen. It is needless to say that the conditions are not always favourable; distension of the intestines with gases so as to bulge and distend the abdominal walls will necessarily interfere with palpation of the abdomen; then, again, a fractious and crying child is necessarily difficult to examine in this way. But even under the most unfavourable circumstances, the warm hand, laid on the abdomen and firmly pressed in, may detect a tumour or some enlarged organ, and information be gained which may be of great advantage in making a diagnosis. Even ascertaining the tenderness or lidity of the abdominal walls is of importance in forming a diagnosis between cerebral and gastric vomiting, as in cerebral disease there is usually a relaxed state of the walls of the abdomen which enables the edge of the liver and perhaps other organs to be felt with abnormal distinctness; while, on the

other hand, in gastro-intestinal disorders there is usually more or less distension of the stomach and bowels, the distended organs interfering with a thorough exploration of the abdominal contents. Palpation may give valuable information with regard to pain and tenderness in the abdomen, provided the observer is alive to the fallacies which may arise through the fractiousness of his little patient.

By *percussion* the investigator is able to confirm the results obtained by palpation, and gain information not otherwise obtainable; thus he may map out by percussion the outline of a dilated stomach, or ascertain the limits of fluid in the peritoneum.

Anatomically the abdomen of the infant differs from the adult's in that the liver is proportionately larger in the newly born infant, occupying at least half of the abdominal cavity. The inferior limit of the liver is consequently lower, and the left lobe covers the stomach to a greater extent in the infant than in the adult. The infant's stomach, so far as shape is concerned, does not differ in any important respect from the adult's; the cardiac curvature is perhaps less well marked, and it comes into closer relation with the liver and spleen. As a consequence of the thinness of their walls, the stomach and intestines are apt to become dilated during infancy from the pressure of gases given off from their contents, and to remain more or less constantly in a distended state. The large intestines—more especially the cæcum, ascending colon, and sigmoid flexure—are fairly movable, and consequently more easily dragged from their normal position, in infants than in adults.

This is especially true of the sigmoid flexure; for sometimes at an autopsy the sigmoid flexure, if distended with gas or feces, may be found much displaced towards the right side. This must be remembered in palpating the abdomen, for faces which from their position may appear to be in the ileum or cæcum may in reality be in a displaced sigmoid flexure.

The Dyspeptic Diseases of Infancy and Childhood.—No infant, whether fed at the breast or with artificial foods, escapes having indigestion in one form or another; various dyspeptic ailments are certain sooner or later to supervene and form no insignificant part of the troubles of an infant's life. We have not far to go to seek an explanation of this. The alimentary canal of an infant is exceedingly intolerant of any form of irritation, while, with very slender resources to fall back upon, it has to perform a large amount of work in the digestion of food in order to make good the losses incident to life and supply suitable material for the rapid growth which is taking place. During the whole of infancy the digestive apparatus is worked to its uttermost capacity in digesting the food required for the infant's maintenance and growth, and any overtaxing of its powers is very likely to be followed by disturbed function. The commonest causes of indigestion in infancy are practically the same as those in adults, the appetite perhaps—in excess of the digestive powers, and more food is taken than can be digested, or the food taken is of an improper quality; in both cases the result is the same, the presence of decomposing food in the alimentary canal giving rise to vomiting, flatulence, and diarrhoea. In some cases the vomiting points to the stomach being most affected; in others the passage of loose stools containing undigested food, with much flatulence, indicates

that the small intestines are involved, the large bowel when colic, tenesmus, and an excoriated condition of anus are present. Before long a catarrhal condition of the mucous membrane is set up, or in the milder cases perhaps there is a deficient secretion of the digestive juices, or they are impaired in quality so that the food taken undergoes decomposition, irritates the bowels, and leads to its being quickly expelled instead of undergoing the normal process of digestion and absorption. In discussing these dyspeptic conditions arising during infancy and childhood, it is convenient to consider the prominent symptoms separately, always bearing in mind, however, that they are only symptoms of morbid conditions and not diseases.

Flatulence and colic may be present unaccompanied by either vomiting or diarrhoea, both breast-fed and bottle-fed babies alike suffering, though the latter do so more frequently. It is the result in many instances, perhaps most frequently, of the infant taking in food too quickly and in too large quantities; digestion is performed imperfectly, decomposition in the small intestines ensues, and gases are formed which distend the bowels. The abdomen is distended, the infant is restless and cannot sleep, it is constantly crying and tossing about, and if it brings up or passes large quantities of flatus, there is much relief. Ease for the most urgent symptoms may be found in giving the infant a tea-spoonful or two of an equal quantity of lime water and cinnamon water, or small doses of carbonate of ammonia and soda in peppermint water, or a small piece of the compressed salts known as 'soda-mins,' dissolved in a little syrup. It will be necessary, temporarily at least, to lessen the amount of food which the infant is taking; this may be done in breast-fed children by giving them some sweetened barley water or slory before taking the breast and not allowing the breast to be given for too long or too often. In artificially-fed infants the amount of food, especially the amount of cord, must be reduced either by diluting with barley water, lime water, or by pre-digesting the cord. Large quantities of warm water (10-15 oz.) and hot fomentations to the abdomen will generally relieve the severer cases of colic due to flatulence, and a grain of mercury and chalk powder combined with half a grain of Dover's powder may be given by the mouth. Carbonate of magnesium with syrup of ginger is often useful.

Vomiting.—Vomiting is a very common complaint for which medical aid is sought. That this vomiting is readily brought about is hardly to be wondered at when it is remembered that what vigorous an infant will suck, and yet the stomach of a newly-born infant cannot hold more than a wine-glassful of fluid without being over-distended, and that, moreover, during digestion active peristaltic movements take place. The most frequent way in which food is rejected from the stomach is what is termed by mothers 'spitting,' which consists of eructations of small quantities of fluid from time to time without any effort, the food escaping from the corners of the infant's mouth in consequence of a too vigorous peristaltic action of the stomach. Fluid will also frequently regurgitate during the eructation of gases from the stomach. In true vomiting there is more or less forcing, and the contents of the stomach come up with considerable force. The most frequent cause of this is an irritable condition of stomach due to a catarrhal state of the mucous membrane, the coëling ferment is abnormally active, while the digestive ferment is present in smaller quantity than usual. Vomiting

is especially common in infants who are taking cow's milk, and who are unable to digest the large quantities of hard curd contained in the milk, the stomach probably containing much decomposing curd and mucus. Sometimes the vomiting is the result of over-distension, or the formation of excessive quantities of gases, or of cramping. The vomiting of breast-fed infants is often due to their being given the breast at too frequent intervals, or to some other cause, as the ingestion of unsuitable food on the part of the mother; or she may be suffering some gastroenteric, which is in itself quite sufficient to cause an alteration in the quality of the breast milk. Vomiting may be the result of some congenital or acquired obstruction of the bowels. It must also be borne in mind that vomiting in infants and children is frequently reflex, and not due to any lesion of the stomach, but the result of cerebral disease, as meningitis, or tumour, or of the irritation caused by cutting a tooth. Vomiting is sometimes the first, and for a time the only, symptom in tubercular meningitis, and may precede for a week, or even longer, any marked cerebral symptoms. Besides vomiting may at first be entirely unaccompanied by dyspeptic vomiting; the condition of the tongue is no certain guide, and it is only as the cerebral symptoms become more marked, the abdominal walls either contracted or in a tense, flabby condition, that a diagnosis can be made. In older children the vomiting of an acute gastric catarrh may last for a few days, but any long-continued or habitual vomiting is very suspicious of cerebral disease. Hysterical vomiting is occasionally seen in girls about puberty. Vomiting is usually an early symptom of scarlet fever and also of influenza.

The treatment of vomiting must necessarily depend upon its cause. Vomiting in the breast-fed infant, provided the mother's manner of life and diet is not at fault, is probably the result of too large quantities of milk being taken, and it will generally be sufficient to insist upon regular hours of feeding at not too frequent intervals, and to give the infant a few teaspoonfuls of sweetened lime water before it has the breast, with a dose or two of *hyd. c. creta* to act on the bowels. Vomiting in the bottle-fed infant is more difficult to deal with, especially when a gastric catarrh exists. The infant is under these circumstances very intolerant of cow's milk, even when largely diluted, the milk being quickly curdled by the acid mucus in the stomach, and the hard lumps of curd are vomited in masses. In the milder cases of vomiting in infants, it may probably be sufficient to resort to dilution of the milk with barley water in the proportion of one-third to two-thirds of the latter, or to the use of Mellin's Food. Sterilised milk and condensed milk or dehydrated milk, if properly diluted, are nearly always retained more readily than fresh cow's milk by infants who vomit. Whatever food is resorted to, great care must be taken that too large quantities are not given at a time or taken too quickly. In severe cases, where no form of fresh milk is tolerated, milk peptonised by the addition of Benger's peptonising powders, or the condensed peptonised milk sent out in tins by Sankey & Moore, are frequently useful, and are retained when no other form of milk is tolerated. If the vomiting is severe and continued, the bottle must be done away with and the infant fed by the spoon, or a wet nurse may be obtained. In some forms of severe vomiting there is an inability to retain any form of milk, and real broth or barley water must be resorted to for a while at least. An alkali, such as car-

bicarbonate of soda, with two or three grains of pepper in powder, may be given before meals, and is often of use; or lemon-juice and rice-water may be given. (F. 5.) Washing out the infant's stomach is often a useful expedient: the infant resting on its back after acid stains and decomposing curd have been washed out.

Diarrhœa.—Looseness of the bowels is symptomatic of many different disorders and morbid conditions. An attack of diarrhœa frequently usher in scarlet fever, or may be present in all stages of the malignant form: it may accompany typhoid fever; it is often present in septicæmia, erysipelas, uræmia, peritonitis. The commonest form in children is the result of an accumulation of undigested food in the intestines, or of some irritating matters taken in the food. Infants at the breast are liable to suffer from looseness of the bowels soon after birth on account of the substratum not agreeing with them; they are also liable to suffer from the taking of improper food on the part of the mother during lactation; over-feeding on a fit of anger, or other strong emotion on the part of the mother, has been known to be followed by diarrhœa in the infant. Artificially fed infants are much more liable to suffer than infants at the breast. The difficulty with which the curd of cow's milk is digested overtaxes the digestive powers, the undigested curd irritates the bowels, and increased peristalsis is set up. An intestinal catarrh is soon established, the infant is restless, peevish, and cannot be got off to sleep, the abdomen is distended with gas, the legs are drawn up, and the infant passes perhaps five or six stools or more per diem.

An examination of the napkin shows, instead of the bright yellow homogeneous stools of the healthy infant, curdy flakes or other undigested food, and a greenish slaty liquid which stains the diapers. The infant is thirsty, takes the breast or the bottle vigorously at first, but is soon satisfied and settles away when offered. The tongue is coated and the mouth is often the seat of aphthous stomatitis. Vomiting may be present, but is mostly absent. In a day or two the infant begins to waste, the muscles of the limbs grow flabby, and the skin hangs about the thighs in loose folds, and the parts about the anus and genitals become red and frequently raw. In most cases improvement takes place after a few days; the stools become more normal and the infant quickly recovers. Some infants are liable to such attacks especially during hot weather, and the final result may be a more or less chronic condition of catarrh, to end finally in general malnutrition from gastro-intestinal atrophy. Bickets is a very frequent sequæe of intestinal catarrh.

Not infrequently the symptoms point to a catarrh of the large bowel, and are more of a dysenteric character. Dysenteric diarrhœa may be primary, or follow an attack of simple diarrhœa, the general affection passing away and leaving a local inflammatory condition in the colon, sigmoid flexure, and rectum. The same form of diarrhœa frequently succeeds whooping cough and measles. There is distension of the abdomen, with often more or less tenderness in the left iliac region or previous, frequent passage of small liquid stools, consisting largely of mucus, biliary matters, and perhaps blood, preceded by much straining and forcing down and frequently followed by prolapse of the rectum. Older children often suffer from this form of catarrh of the large bowel, passing lumpy mucoid stools, and getting up perhaps

several times in the night to sit on the vessel, only passing each time a little mucus streaked with blood. Dysenteric diarrhea is apt to become chronic, alternately better and worse, until the patient is reduced to a condition of wasting.

Sometimes dysenteric diarrhea occurs in epidemics, in winter as well as in summer. We have known several such epidemics.

Older children sometimes habitually suffer from what has been termed 'dysenteric' diarrhea, in which a loose stool is apt to follow the ingestion of food. Such children are generally subject to loose bowels, a diarrheal stool following any form of excitement, especially a fright, the immediate cause being an exaggerated peristaltic action of the ileum and colon. There is often in such cases a catarrh of the large bowel, as evidenced by the excess of mucus which they pass: phthisical children also may suffer in this way. A form of diarrhea which has been termed 'fat diarrhea,' from the presence of an excessive quantity of fat in the stools, has been described, which is presumably due to catarrh of the duodenum and pancreatic duct.

In the slighter forms of diarrhea in infants, where there is not much restlessness, distension of abdomen, and not more than four or five loose stools during the day, it will be usually sufficient to withhold them for a day or two, and give them some mild laxative, as castor oil or hyd. *creta*, and a simple alkaline mixture. Infants at the breast may be given a few spoonfuls of sweetened barley water in lieu of the breast, or after they have been partially satisfied at the breast. Bottle-fed children should have their milk more diluted than usual, or a mixture of cream and barley water may be substituted for the milk.

If the purging is in all severe and curdy masses are vomited, or appear in the stools, it will be best at once to withhold all milk for a day or two, and to substitute some more digestible and less fermentable food. Peptonised milk will sometimes answer very well in the less severe forms of diarrhea, but it must be borne in mind that in any given case much of the curd remains unconverted into peptones, and the unchanged curd may often be seen in large quantities in the stools, even where great care has been taken in the peptonising of the food: peptonised milk is of more service in gastric catarrh and vomiting than in acute diarrhea. In the severer cases, where the stools are frequent, the blandest and most nourishing foods must be given: such, for instance, as—

Arrowroot water	2 ounces
Whey	2 "
White sugar	1 teaspoonful
or—	
Barley water	16 ounces
White of egg	1 ounce
White sugar	1 or 2 teaspoonfuls

Either of these may be given out of a bottle every few hours, and in amounts according to age. Veal broth is also very useful.

The medicinal treatment in the early stage consists in giving a laxative for the first twelve or twenty-four hours. In these cases the diarrhea is

probably the result of a congestion of the mucous membrane of the intestine, and of the presence of irritating, perhaps pallescent materials, and it is wiser to assist elimination than attempt to prevent it by means of opium or astringents. To this end emulsion of castor oil or small doses of calomel ($\frac{1}{2}$ to $\frac{1}{4}$ grain) may be given, the latter being preferable if there is vomiting, on account of its being more readily retained by the stomach. (F. 6.)

By the end of twenty-four or forty-eight hours the laxative will have done all that can be expected of it, and the stools will be yellow, homogeneous, and less frequent. A sedative may now be used, such as bismuth or zinc. (F. 7 and 8.)

In the majority of cases of simple diarrhoea the attack is arrested by these means—namely, a liquid diet in which milk is excluded or given sparingly, and a laxative for a day or two followed by bismuth or zinc. It not infrequently happens, however, that a simple diarrhoea without urgent symptoms passes suddenly into the acute or inflammatory form, or, on the other hand, it may end in a more or less chronic condition of looseness of bowels with marked loss of flesh.

As improvement takes place, milk diluted with whey or Mellin's Food may be allowed in small quantities, or, what is useful and readily prepared, milk diluted with twice its bulk or an equal quantity of arrowroot water (a teaspoonful to 10 ss.) and sweetened with white sugar. Malt extract may be added a few minutes before the food is taken. During convalescence, diluted acids with peppine or astringents are the best remedies. (F. 9 and 10.)

Constipation.—Constipation is one of the minor troubles which are of most frequent occurrence during infancy, and for which the advice of the practitioner is sought. Both breast-fed and artificially fed infants suffer, though the latter far more frequently and severely than the former. The healthy infant passes two or three semi-lipid homogeneous orange-coloured stools daily without effort or straining, while some infants appear to have a difficulty in defecation from want of expelling power, but at once pass a fairly healthy stool if the colon is reflexly stimulated by inserting a small suppository into the rectum. In the majority of cases, however, in which constipation exists, the stools are dry and pale with an excessive quantity of mucus, and an evacuation only occurs once a day, or perhaps once every two or three days. There is usually much straining before the stool is passed, and perhaps some mucus tinged with blood may accompany or follow the stool. Infants who suffer much from constipation are usually weakly, anæmic, and dyspeptic, but they are by no means always badly nourished as far as fat is concerned. Rickety children during their second and third years mostly suffer more or less from constipation.

It must be borne in mind that constipation is only a symptom, and may be the result of grave cerebral disease, or there may be some congenital malformation of the intestine. In the majority of cases it is the result of a want of tone in the large bowel, which in chronic cases may be dilated, the peristaltic action being sluggish and not easily evoked; while the intestinal juices are scanty and the bile deficient in quantity. Mucus appears in these children to be secreted in excess. There is apparently also a deficient digestion of the curd of milk, the feces contain an abnormal quantity of solid matters which accumulate in the colon as it is powerless to expel

them. In some cases constipation is due to a deficiency of fat in the food, the faeces possibly contain fat, and it appears to act as a natural purgative. Fluid faeces in the colon seem much more readily to excite peristalsis than solid fecal matters. Infants who are constipated usually have abnormally distended abdomens, and fecal masses may often be felt in the transverse and descending colon. In some cases constipation is distinctly hereditary; mothers who suffer much from this trouble often have infants who also suffer in this way. It seems likely that in some instances the mother's or nurse's milk may be poor in quality, and especially deficient in fat, and there may in consequence be a small amount of fecal matter. It must not be forgotten that narcotics in small doses constipate, and bromides—though in less degree—have the same effect.

It is needless to remark that constipation is a frequent trouble not only in infants, but also in both young and older children. Fat, tickly children, who are late in walking, very frequently suffer in this way. In some, constipation and looseness of bowels alternate with each other. It mostly, perhaps, occurs in those children where milk in too large quantities is given and is not well digested, as evidenced by the large solid pasty stools. In older children it occurs in those who take little exercise, and who have large appetites; though in some of these cases it appears to be hereditary. If an infant at the breast suffers from constipation, care should be taken to free inquiry into the diet and habits of the mother or wet nurse. An analysis of the milk may be made to determine the amount of fat; it may be necessary for the mother to take more in the way of stewed fruits or some laxative medicine, such as confection of senna or castor-oil. In some cases the infant's stools may be fairly normal, and the infant appears to suffer from a want of expelling power; this may be overcome by gentle friction of the abdomen with the oiled hand, or it may be necessary to reflexly stimulate the colon and abdominal tissues by introducing into the rectum a small soap or other suppository, or a few drops of glycerine and water. In artificially fed infants of feeble digestive powers, treatment is often much less successful. The first consideration is the diet; this will probably have to be changed in the direction of diminishing the quantity of food, increasing the amount of fat, and adding some form of malted food or extract of malt. Oatmeal water, or a small quantity of freshly prepared oatmeal added to each bottle, may have the desired effect. Persistent and carefully applied massage to the abdomen by a trained nurse is of much value in obstinate cases of habitual constipation. Emulsion of glycerine and water (2ss-3j) or olive oil are preferable to medicines for habitual use. Glycerine suppositories are often successful. Bitter and narcotic medicines are to be avoided as far as possible, for it is more than likely they will not be persevered with by the nurse or friends. In slight cases five or ten grains of the old-fashioned rhubarb, or a teaspoonful or two of fluid magnesia, may be added to the food as often as is necessary, but it is more than likely both of these remedies will have been tried by the friends before medical advice is sought, and indeed they will only be of service if slight and easily overcome constipation. When these fail, small doses of calomel ($\frac{1}{4}$ -1 grain) twice a day for a few days will, if aided by enemata, often succeed in bringing about a more satisfactory state of things, for a while at least. The fluid extract of castor-oil in five to ten minims doses made into a

cardial with tr. and syrup of orange peel is often useful for continued use; liq. jalape res. or injectio gly. jalape res. may be of service. We have often found liq. bellad. and pepsine or liq. extractum and pepsine in 15 to 20 minin doses very useful in the constipation of infants and children.

In older children the diet must be carefully regulated; pastry, salt meat, and sweets must be forbidden, while oatmeal, green cooked vegetables, stewed fruit, orange juice, stewed prunes and figs, may be given with discretion. Sponging with cold water in the morning, plenty of outdoor exercise, and only a moderate amount of brain work, should be insisted on. Of medicines, the most efficacious are some of the mineral waters, such as Ralsaut, Essonay, Fress (food given in warm water or milk overnight or the first thing in the morning). Citrates containing $\frac{1}{2}$ grain of aq. extract of aloes or calomel $\frac{1}{2}$ grain, with ex. coloc. co. $\frac{1}{2}$ grain, are useful; or $\frac{1}{2}$ grain of res. podophyll. But we frequently find in practice that children will neither take mineral waters nor grundles, and we have to fall back on such drug sweetmeats as cascara chocolate lozenges, or tamar indian lozenges, which are pleasant to take, and in some instances at least very effectual.

The B. and W. tablets of cascara or cascara comp. or bisphateneds (Sippenbeeren) of sulphate of iron and aloes or cascara are readily taken by older children. In anæmia with constipation the old-fashioned mixture of ferrous sulphate and mag. sulph. is very efficacious, but nauseous. (F. 11.)

Acute Gastric Catarrh

If a child is suddenly attacked with vomiting and high fever, the probability is strong that the symptoms are due to the onset of some systemic disease, such as scarlet fever or epidemic influenza, or to gastric irritation. In infants the symptoms may indicate the onset of the so-called 'cholera infantum,' or symptomatic diarrhoea. It is, of course, quite possible that the vomiting and fever may be due to a chill; but it is far more likely to be the result of some serious error in diet. In any such case, inquiry must be made as to the food the child has taken during the few hours preceding the attack, as well as to the possibility of a scarlet fever infection, and the throat and skin must be carefully inspected. In some children there is a special liability to the so-called bilious attacks, which are in all probability really attacks of acute gastric catarrh. There is headache, nausea, vomiting, and fever; the stomach may reject first some indigested food, then more or less bile-stained fluids. In a few days the attack passes off and the child is perhaps better in health than it was before the attack, the vomiting and thorough emptying of the stomach having had a distinctly salutary effect.

In some cases of acute gastric catarrh there is constant and uncontrollable vomiting for some days.

In acute gastro-enteritis, the result of taking some toxins from meat or milk, the vomiting, colic, and diarrhoea are often excessive.

In all cases of acute gastric catarrh it is important to give the stomach a temporary rest by avoiding all food or fluids, and giving a little ice by the mouth till the vomiting ceases. Rectal alimentation may be resorted to if necessary. Veal broth and peptonised milk are the most likely foods to be retained by the stomach, but it is not wise to attempt to give food by the

stomach too soon. Small doses of calomel are useful if the bowels are confined; dilute hydrocyanic acid and ipecacuan are also useful in checking the vomiting.

Acute Gastro-intestinal Catarrh. Inflammatory or Zymotic Diarrhoea, Cholera Infantum

With the commencement of the warm weather in June or July there is an increase in the number of cases of *infantile diarrhoea*; and by the time the end of July or the beginning of August is reached—especially if the weather is close and dry—there is tolerably certain to be, in large cities, an epidemic prevalence of diarrhoea. It must be within the experience of all that the diarrhoeal diseases are commoner in summer than in winter, and, moreover, that there is more diarrhoea in a hot dry summer than in a cold and damp one. The following figures show these facts in a forcible manner; they are taken from the records of the Children's Dispensary, Manchester.¹

Monthly Admissions of Cases of Diarrhoea for the year 1880

	No. of cases	No. of deaths	Mean lowest and mean highest temperature
January	17	—	26-41 F.
February	24	—	34-42
March	19	—	34-37
April	26	1	37-59
May	19	—	59-64
June	45	2	67-71
July	39	4	52-74
August	152	13	55-73
September	254	43	51-73
October	62	13	37-56
November	18	—	28-55
December	13	—	32-52
Total	612	66	

These figures show that there are at all times of the year a certain number of cases being brought for medical aid on account of diarrhoea, the number being fairly constant during the first five months and the last two months of the year; with the warm weather of June the number increases, reaching its maximum in the hottest weather of August, then declining to the annual number in the last two months of the year. The year 1880 was a more than usually hot summer for this country, but other years show the same relations between the diarrhoeal disease of the winter and summer months, though in cooler summers the disproportion is not so great.

¹ By 'diarrhoea' are meant those cases in which diarrhoea was a prominent symptom.

The same story is told by the mortality tables of diarrhoea in Berlin (Baginsky), in New York (Siebert), and also in Baltimore (Miller); but in these cities the greatest mortality is in July, which is their hottest month, while in this country August is usually the hottest month, and the month when diarrhoea is most prevalent. The above table bears out the general statement that diarrhoea begins to be prevalent whenever the average temperature of the twenty-four hours reaches 60° F., and whenever this average temperature is exceeded by only a few degrees, diarrhoea prevails in a widespread epidemic.

A similar table showing the corresponding number of cases of bronchial catarrh and bronchitis would show that these diseases were more prevalent and fatal during the cold and damp months of the year than in the warm and dry months; and it has been argued that, just as bronchitis is produced by exposure to cold and damp, so diarrhoea is caused by a high temperature, giving rise to an intestinal catarrh or to a 'heat stroke.' But there are facts to show that the explanation is not so simple as this. It is certain that a single exposure to a high atmospheric temperature does not give rise to an intestinal catarrh; that hot weather does not at once increase the number of cases of diarrhoea, but it is only after a high temperature has continued for some days; and that infants at the breast, especially those under three months, though exposed to the same conditions of temperature, are only exceptionally attacked.

Summer diarrhoea is much more prevalent and fatal in large cities than in country districts, and among the poorest classes who live in back-to-back houses in crowded courts and low-lying districts, while it is much less common among the better-housed classes of society, especially among those who live in the country or suburbs and upon a high and breezy site.

It is most prevalent between the ages of three months and two years. The infants who suffer most are the weakly and dyspeptic ones, who are perhaps already suffering from an intestinal catarrh, and who are badly fed and improperly cared for—such, for instance, as the illegitimate class of infants who are put out to nurse. The infants who suffer least are the breast-fed infants; thus out of nearly 2,000 fatal cases recorded by Ernest Hart, only some 3 per cent. had been breast-fed. This immunity is no doubt due to the fact that the milk they take is 'sterile,' and not swarming with organisms as cow's milk is apt to be.

The epidemic prevalence of summer diarrhoea has been attributed, with more or less plausibility, to the ingestion of sour milk, green fruit, inhalation of sewer gas, emanations from the soil: and possibly each of these may contribute to the cases of diarrhoea. That they are not the constant and invariable cause is certain, as infants fed on sour milk by no means invariably suffer from diarrhoea, and the epidemic is too widespread to be explained on the unique fruit theory; and, moreover, diarrhoea is not especially prevalent in some towns where sewer gas is constantly present in the houses (Ballard). While it is certain that the ordinary lactic acid changes occurring in milk when it turns sour are not the cause of diarrhoea, yet there is a strong probability that milk often is the vehicle by means of which certain micro-organisms or poisons enter the system, and give rise to the symptoms which are present in diarrhoea.

Flügge has recently shown that some of the spheric bacteria which are often present in milk, being derived from cow faeces, haystacks, street dust, act on the casein and form peptones and proteines without hurting the milk soon. Milk peptonised by these bacteria produces diarrhoea, and even death in mice and guinea pigs. A high temperature favours the development of these bacteria.

That the diarrhoeal diseases are epidemic in hot weather is certain. Any of the forms also infectious¹. In some recorded cases it certainly appears this has been so. Dr Bruce Low² gives an account of four different outbreaks of diarrhoea in which it appears that the disease was communicated by contagion.

Among the conclusions which various observers have arrived at with reference to the etiology of summer diarrhoea, we may mention the following.

Ballard believes the cause to be a miasm-organism not yet detected or isolated which is constantly present in the superficial layers of the earth, which, entering the food, develops under favourable conditions—either inside or outside the body—a virulent poison or poisoness, which gives rise to the symptoms observed in the disease. This unknown micro-organism is supposed to play the same part in producing the disease as the comma bacillus does in Asiatic cholera.

A. Baginsky, after an exhaustive experimental inquiry into the micro-organisms found in the stools of infants suffering from diarrhoea, failed to find any specific or pathogenic organism, but found many saprophytic or non-pathogenic bacteria, and he inclines to the belief that the decomposition products formed by these various forms of micro-organisms are the true substances which give rise to the disease.

Ménière, while acknowledging that micro-organisms and their decomposition products when present in milk may give rise to an intestinal catarrh, believes that the acute forms of summer diarrhoea are produced directly by the action of a high temperature, and are in reality a sort of heat stroke, having nothing to do with micro-organisms or poisonous poisoning.

In spite of all the facts before us, we are bound to acknowledge that we have no certain knowledge as to how a high temperature favours the occurrence of diarrhoea. Although the fact that no pathogenic organism has been detected does not dispose in confidence, we are not yet in a position to accept the conclusion that summer diarrhoea is a definite systemic disease like Asiatic cholera or scarlet fever. A high atmospheric temperature, maintained for days and nights together, favours the development of all sorts of saprophytic organisms, which can grow in every kind of food, both animal and vegetable, especially in milk, and, under certain conditions, produce poisons such as mactaric acid, which, when taken into the stomach, give rise to an irritant poisoning, with fever, depression and collapse. It is certain that these organisms can flourish both inside and outside the body, and there is much reason for believing that they play an important part in giving rise to the severer forms of diarrhoea prevalent in the summer.

Symptoms.—The symptoms may supervene suddenly in an infant in apparent health, though more frequently an infant is attacked who has

¹ Supplement to the Nineteenth Annual Report of the Local Government Board, 1891-95, 11.

already suffered for a day or two from intestinal disturbance or has had an attack of diarrhoea a week or two before. The first symptom is generally vomiting; this is followed by a loose motion and accompanied by more or less fever, at the same time the infant is restless and irritable, the abdomen is distended with gas, and the legs are drawn up. The vomiting in the severest cases is very distressing, everything taken being rejected immediately, the vomited matters consisting of undigested food, and subsequently of simple mucus tinged with bile; the stools are watery and consist of undigested food; they are usually at first yellow and frothy, or green, containing lumps or flocculi of curd. Later, in severe cases, they consist of little else than slightly coloured water, or resemble the rice stools of cholera, and as the attack becomes more chronic they are of a dirty brown colour and very offensive. The tongue becomes coated with a thick white fur, the thirst is mostly extreme, the child eagerly taking the bottle or spoon, but vomiting immediately afterwards; there is great restlessness, the child may doze for a short time, but rarely manages to get off into a sound sleep.

The fever is seldom high and mostly intermittent, varying from 99° F. to 101° F., in exceptional cases 102° F. or still higher. The stools become more and more frequent as the disease advances, sometimes being passed every few minutes, perhaps escaping unconsciously or being preceded by a short cry or an expression of pain on the infant's face. Very often more or less erythema or excoriation occurs about the anus and perineum. After a longer or shorter period, according to the acuteness of the case, symptoms of collapse make their appearance. There is a change in the infant's face which strikes the most casual observer; the eyes are sunk in the head and kept partly closed, the fontanelle is depressed, the face is pallid or of an earthy tinge, the muscles of the neck and limbs lose their tone, and the head rolls about when the infant is moved. There is no longer any great restlessness, the infant is generally listless and drowsy, and takes little or no notice of its friends. In this stage the vomiting usually ceases, the stools become less frequent and are smaller, and the abdomen becomes swollen and its walls flaccid.

The further progress of the attack depends upon whether improvement sets in; if so, the diarrhoea ceases, there is less colour return to the infant's face, it takes notice of its friends, and, though still weak, begins to use its limbs and take its food. In other cases it becomes more exhausted, it wastes rapidly, parasitic stomatitis makes its appearance, and frequently convulsions occur, which quickly bring the end. The fatal event is often preceded by the occurrence of cerebral symptoms, such as coma and Cheyne-Stokes respiration, a condition which has been termed '*false hydrocephalus*' from its resemblance to meningitis, and indeed it is often believed by the friends and others that death has occurred through 'water on the brain.' In this case the coma is profound, the pupils dilated, and at times unequal, the respirations irregular, the child is pallid, and there may be twitchings of the face or limbs. The state of the fontanelle will generally assist the diagnosis in deciding whether the cerebral symptoms are due to arterial anæmia of the brain, as in false hydrocephalus, or to meningitis; in the former case the fontanelle is depressed below the level of the cranial bones, inasmuch as the brain occupies less space than normally, in consequence of the arterial system being nearly empty, the result of a failing heart.

The length of time the disease lasts differs considerably. So rapidly fatal are some attacks that the term *cholera infantum* has been applied to them, and indeed in a few instances this resemblance to Asiatic cholera is very close indeed. Such cases occur much more commonly in the large cities of the continents of Europe and America than in our own cooler climate.

The following case may be taken as an instance.

A boy of five years of age was taken suddenly ill with vomiting and purging at 4 A.M. and died at 2.45 P.M. on the same day. When admitted to hospital at 10 A.M. he was completely collapsed; the pupils contracted, the conjunctivæ greatly injected, the lips were pallid, the pulse could hardly be counted, the temperature was 94° F. In spite of brandy, ammonia, and spirits of astring. he died rapidly. The post-mortem examination showed the body to be well nourished and ripe bones strongly ossified. The intestines were distended with gas, and contained a small quantity of pale greenish fluid, the mucous membrane of the whole length of the alimentary canal was pink with minute extravasations of blood, and the cæcal pouch was enlarged. The tissues generally were pale and dry. The case occurred in August 1881, a summer which was unusually hot, and during which epidemic cholera was very prevalent.

In a few cases, convulsions may supervene during the first few days, and bring about a fatal termination. In the majority of fatal cases the duration is somewhat longer, perhaps a week to ten days, the infant passes through the acute attack, the symptoms then assume more or less of a dysenteric character, and it survives through exhaustion and inanition from a failure of the alimentary canal to recover its normal functions. Many infants who escape with life in August, die in September or October from gastro-intestinal atrophy, which has followed as the result of the acute attack.

Complications.—By far the most common complication of acute intestinal catarrh is broncho-pneumonia, or bronchitis and collapse of lung. The symptoms are apt to be latent, but any dyspnoea or high temperature would necessarily call for a careful examination of the lungs. Thrombosis of the cerebral sinuses occasionally takes place in the later stages, but it is comparatively rare; the symptoms consist in distension of the veins emptying into the cavernous sinuses with oedema of the forehead and eyelids; there will also be tonic spasm of the limbs and neck, and convulsions. *Albuminuria* frequently occurs during acute diarrhoea; nephritis and uræmic convulsions have been described by some authors; but no doubt if the convulsions which frequently occur towards the last are uræmic. Peritonitis occasionally occurs, hyperpyrexia may also occur.

Sequence.—Should the infant recover from the acute attack, it is by no means certain that complete recovery will take place: for it is scarcely probable that gastro-intestinal atrophy may supervene, or a chronic diarrhoea remain, the result of chronic catarrh with follicular ulceration of the colon, sigmoid flexure, and rectum. In the latter case the symptoms are those of dysenteric diarrhoea; defæcation is frequently accompanied by much pain and straining, the stools consist of mucus, often tinged with blood, or are dark brown and liquid. The rectum becomes prolapsed, and is sometimes returned with difficulty, and the child rapidly wastes. Not infrequently we see children, usually under two years of age, who have gone through a severe attack of diarrhoea, extremely atactic, and whose subcutaneous tissues, including the face, are oedematous. In such cases a trace of albumen may be found in the

urine, but it is usually free from albumen. They have been described by some authors as suffering from nephritis. Our own experience is that the kidneys in such cases show very little pathological change, and moreover urine is freely secreted during life. This sequela, whatever may be the pathology of it, is, we are inclined to believe, the result of primary poisoning.

Diagnosis.—The principal difficulty in diagnosis occurs in the acute form of the disease, as it may be confounded with acute scarlet fever, sunstroke, or infant poisoning, such as from eating poisonous fungi. We have several times been requested by a coroner to make a *post-mortem* on a child who has been seized with vomiting, purging, and high fever, with great depression, followed by death in a few hours; and we have been unable to say for certain, from the *post-mortem* appearance, whether the death has been due to malignant scarlet fever or acute inflammatory diarrhoea. The problem has been solved in some instances by the occurrence of scarlet fever in the same house shortly afterwards. In the majority of cases the appearances seen in the throat would suffice for diagnosis. The diagnosis between sunstroke and acute cases of cholera infantum may be difficult, as there may be a high temperature in both; but in most instances the gastro-intestinal disturbance is much more marked in the latter than the former. It must be borne in mind that some consider cholera infantum to be really cases of 'ham stroke.'

Prognosis.—Acute intestinal catarrh must always rank as a serious disease, not only from its tendency to prove fatal during the attack itself, but because it so frequently passes on into a subacute or chronic form of catarrh to be succeeded by atrophy. The younger the infant, the more serious the prognosis becomes, especially if it has been artificially fed; in older children, though the attack may be severe and the depression produced very great, the disease usually terminates favourably. The onset of cerebral symptoms is of very unfavourable augury, and the chances are against the infant, though the case is not hopeless. Convulsions are generally followed by death. In those cases in which infants lapse into the chronic stage the prognosis is serious, as they are already exhausted by the acute attack.

Morbid Anatomy.—If death has taken place early in the disease, the body is well nourished and perhaps even plump, but the face retains the same expression it had during life, the eyes and cheeks being sunken. On opening the body, minute hæmorrhages are usually present on the surface of the lungs and heart, and there is hypostatic congestion at the bases of the lungs. The mucous membrane of the stomach and bowels is swollen and pink from capillary congestion, the congestion often being present in patches, and minute hæmorrhages may have taken place. The mucous membrane of the large intestine is congested, especially along the summit of the folds of the membrane. An excess of mucus is generally present, and the contents are liquid. The Peyer's patches and solitary glands are most frequently swollen; the kidneys are pale, the cortex frequently enlarged. In the later stages, the body is more or less emaciated, the lungs are semi-solid at their bases from the presence of catarrhal pneumonia, the mucous membrane of the small intestine is swollen and congested, but the principal changes will be noted in the large intestine. Here the mucous membrane is generally much congested, especially about the cæcum and descending

colon, there may be superficial ulceration or excoriation at the vertices of the folds of mucous membrane, or the bowel may be pitted with deep but small ulcers from the results of becoming clogged and discharge of the solitary glands. Microscopical examination of the intestines shows a distension of the network of capillaries of the villi and mucous membrane, and an exudation of leucocytes is mostly present in the sub-mucosa and between the tubules or crypts of Lieberkühn. Numerous micro-organisms are present. The solitary glands especially in the large bowel are very often in a state of softening in these centres, as their contents have discharged, giving rise to sharply cut ulcers.

On examining the brain, no constant or indeed definite lesion is found; in most cases the sinuses are distended with blood or occupied by a firm pale clot, but this condition of engorgement appears to be the result of death taking place through cessation of respiration, or during a convulsion, and is due to mechanical causes from interference with the return of blood to the lungs. The symptoms referable to the brain during the last few hours of life, coma, Cheyne-Stokes respiration, &c., have been attributed to exhaustion and an anæmic (arterial) condition of brain due to diminished cerebral tension. The suggestion that they are due to uræmia is improbable, though it is as unlikely they are due to the absorption of poisons from the alimentary canal. Meningitis is extremely rare; in one case, however, which came under our notice, lymph was found about the optic commissures.

Treatment.—The most important part of prophylactic treatment is connected with the food which the infant takes and the purity of the air which it breathes. No weakly infant who is being reared on artificial food and who has previously suffered from intestinal catarrh ought, if it is possible to avoid it, to remain in the crowded part of a large town during the hot weather, but should be sent away to a breezy seaside place, or country quarters should be selected among levery hills. The greatest care should be exercised in the selection of pure milk and in its storage before it is taken by the patient, as there is little doubt that milk readily absorbs noxious gases, is easily contaminated by micro-organisms present in the atmosphere, and changes are set up which render it unfit for food. All milk taken by infants and children during the summer months should be carefully sterilised in one of the milk sterilisers sold for the purpose. Care must also be taken that the infant is not given food in excess of its digestive powers, as undigested food or other foods are exceedingly likely to decompose in the alimentary canal and give rise to irritation and diarrhea. The stools, both of infant at the breast and bottle-fed children, should be carefully watched, and any traces of undigested food or of unusual freshness or looseness of stools should be the signal for lessening the amount of food taken. No infant at the breast should be weaned during the continuance of the hot weather, and if diarrhea makes its appearance it should, if possible, be returned to the breast.

The indications for treatment when the diarrhea has commenced are:—the first place to give a laxative to clear away all irritating or decomposing foods and relieve the congested bowel, and secondly to give food only in small quantities and of the blandest character. The first indication can be fulfilled by giving castor oil, as long ago advocated by Dr. Geo. Johnson, or

by a dose or two of calomel. The former may be given in emulsion in combination with an antiseptic—i.e., boric acid or salicylate of soda; the latter helps to prevent decomposition in the emulsion, and perhaps also plays a similar part in the stomach in checking putrefactive changes. (F. 12.)

The oil may be given by itself in half-teaspoonful or teaspoonful doses, but it is apt to cause sickness. Instead of the castor oil, especially if there is much sickness, small doses of calomel may be given, and on account of its small bulk and tasteless character it is in many respects to be preferred. It is better, if the attack is a sharp one, to give it in small and repeated doses, especially in weakly infants: $\frac{1}{4}$ to $\frac{1}{2}$ grain may be given to infants and young children every two hours, until one or two grains have been given. In the course of twelve hours or more, according to the intensity of the diarrhoea, all appearances of indigested food will have disappeared from the stools, the latter perhaps continuing frequent and watery. Stomach washing and irrigation of the large bowel have been largely practised both on the Continent and in America, and have the great advantage of removing at once the contents of the stomach and large bowel, but no irrigation can reach the small intestine.

Unless the infant be at the breast, all milk or milk foods should be stopped, and barley water with white of egg substituted (p. 82). The most troublesome symptom at first is frequently the vomiting; this may be constant, following every attempt at feeding, and it will be necessary to desist from all attempts at feeding for some hours, only moistening the mouth with a small brush dipped in ice water. Counter-irritation and hot applications to the abdomen at this stage are undoubtedly serviceable. For this purpose a liniment composed of five drops of oil of mustard to an ounce of camphorated oil may be gently rubbed over the abdomen, and spongio-piline or several folds of flannel wrung out of hot water applied. Or the spongio-piline may be wrung out of water at 100° in which mustard has been diffused in the proportion of two table-spoonfuls to a gallon.

The medical treatment of acute diarrhoea is often very unsatisfactory. The vomiting may continue, the stools in spite of the most careful dieting may be loose and frequent, and the child may rapidly lose ground. The drug which one is tempted to fly to is opium in one form or another, in the hopes of allaying irritation and diminishing the disquieting flux from the bowels, which appear to the friends at least to be the cause of the child's increasing weakness and distress. It must, however, be borne in mind that the disease is something more than a congested, irritable state of bowels, in which the contents are rapidly passed downwards into the colon and rectum, since the diarrhoea is rather the result of a form of infant peritonitis. There cannot be the least doubt that in many cases with the cessation of the diarrhoea the child becomes no better, but rapidly passes into a condition of collapse with cerebral symptoms, due in all probability to toxæmia; or the temperature rises and pneumonia supervenes. It must, moreover, be admitted that the treatment of the worse cases of summer diarrhoea by drugs is often unsuccessful, and this is borne out by the number of drugs which have been employed.

The drug which has appeared to us the most successful in the vomiting is the early stages is carbolic acid, the glycerine of carbolic acid being

given in drop doses every two hours or even often. Carbolic acid has a sedative action on the stomach, and helps also to check the decomposition changes which go on. Other drops of a similar class, namely salol, creosote, resorcin, naphthalin, have been given as antiseptic remedies in the hopes of checking the putrefactive changes in the bowel and preventing the formation of toxic products. Salicylate of soda has also been used by A. Jacob, of New York, and also Dr. Emmet Holt; he gives it in doses of one to three grains every two hours according to age. Resorcin may be given in $\frac{1}{2}$ to 2 grain doses dissolved in water every two hours. Both bismuth in the form of carbonate and oxide and zinc oxide (F. 7 and 8) are usually of undoubted service. Opium, in the early stages, is useless and harmful, more especially when there is undigested food in the stools and where the vomiting is persistent. In the latter stages, if the stools continue small and numerous, especially if they approach the dysenteric type—the large bowel being chiefly involved—opium is of much value in soothing the patient and diminishing irritability. It is best given by enema. The advantage of the former method is that it is more slowly absorbed and its typical effects are absent; one or two enemata of laudanum during the twenty-four hours will mostly relieve the irritative diarrhoea, when accompanied by straining and colicky pains, without the necessity of omitting or altering the medicine given by the mouth. Two to five drops of laudanum may be given in warm decoction of starch per os even to an infant of six months to twelve months, the effects carefully watched, and repeated in the course of six to twelve hours if necessary; $\frac{1}{16}$ of a grain of morphia may be given subcutaneously to a child over three years of age. If there be much fever, tepid sponging, or in cases of greater severity sponging with ice cold water, may be practised.

Stimulants may be required from the first, but it is wise to reserve them for a later stage, especially as they are apt to give rise to sickness. Brandy, a sweet port, or champagne, are the form of alcoholic stimulants most useful, and they are usually required to be given freely in the later stages if collapse is threatened. Ammonia, camphor, and musk are valuable remedies if symptoms of collapse have made their appearance. Camphor may be given in the form of spirits of camphor, three or four drops every second hour; or musk. (F. 12.)

Camphor and musk are not agreeable medicines to take, and are apt to cause nausea.

Even when convalescence is established great care must be exercised for many weeks in the management of the patient; the child is certain to be left with impaired digestive powers, anæmia, and liable to gastric or intestinal disturbance. A severe attack will often affect the child's health and development for many months, so that it is late in talking or standing alone, and at 18 months or two years of age resembles a child of 12 months old or less. Moreover, the diarrhoea may become chronic or return in a subacute form, and a child may thus be lost who has managed to struggle through the primary attack. The diet during convalescence requires the most extreme care, and a return to milk diet should not be allowed until there is evidence of much-improved digestive powers. Broths and beef tea made with barley or some light starchy food, meat juice, scraped mutton chops, whey, and Mellin's Food, may be given in moderation.

The mineral acids, pepsine wine, decoction of pomegranate bark, the vegetable bitters and astringents, will be useful as the child improves.

Symmetry.—Place the child in the coolest room of the house, and sponge frequently if there is much fever.

Stop all forms of milk food, grong barley or arrowroot water with white of egg, and (real broth); if there is much vomiting stop all food for some hours.

Apply hot fomentations or croton-irritation to the abdomen.

Give castor oil or calomel till all undigested food has disappeared from the stools, followed by salol, zinc, bismuth, or carbolic acid. Later, if there is much restlessness or colic, give opium by the rectum. In severe cases brandy or other stimulant will be required, but it is apt to cause vomiting.

In infants at the breast lessen the quantity of milk taken and give some barley water.

Acute Gastro-enteritis. Ptomaline Poisoning

Under this head we refer to the gastro-intestinal disturbance which follows the ingestion of some food which contains a virulent animal poison. The commonest form of food which contains such poisons is milk, but so may tainted meat, sausages, snailshells or mussels. Ptomaline poisoning is characterised by vomiting, colic, diarrhoea, fever, and the more severe cases by collapse. In an epidemic¹ which we had the opportunity of observing, upwards of one individual were attacked, within a few hours of one another. Both adults and children were affected, in some families as many as twelve were attacked. It was proved that all those who suffered had taken milk from the same farm. On investigation Dr. Niven found that the milk from a cow suffering from 'Gargles,' or inflammation of the udder, had evidently been the cause of the epidemic. Some of those affected had only had a small amount of milk in their tea. We have seen similar attacks following the ingestion of tainted meat by children. It is not certain what form of micro-organisms is the originator of the toxins in these cases, and it is uncertain whether the toxins are formed inside or outside the body. Guertner has described a bacillus which he has called *B. enteritidis*, and found in some cases of sausage poisoning.

Within a few hours of the inception of the poison there is vomiting, which is usually continued, and severe diarrhoea. The colic is very severe sometimes, going on to fulminance. The temperature may rise to 105° F., or in mild cases it may hardly rise above normal. Convalescence is mostly protracted. The diagnosis is aided by the fact that several members of the same family are attacked, and in those cases where the milk supply is at fault several families will suffer who have the same milk. Occasionally influenza takes an epidemic form, and the diagnosis at first may not be easy. But the fact that several members of a family are seized within a few hours of one another, and that no other cases occur, should always raise the suspicion of ptomaline poisoning. The treatment will necessarily be to aid the system in getting rid of the poison as quickly as possible, and then to relieve the excessive colic with sedatives.

¹ See *Concurrence of Milk Infection*, by Dr. J. NIVEN, *Lancet*, Jan. 19, 1894.

Acute Dis-collitis. Dysenteric Diarrhoea

Diarrhoea of a dysenteric character is sometimes secondary to some catarrhal diarrhoea, or it may follow measles, whooping-cough, or other systemic disease. In these cases it is mostly chronic or at the most subacute. There is straining at stool; the excretions contain much mucus and are streaked with blood. Protrusion of the rectum is common. In some cases which occur almost entirely in older children, dis-collitis is an exceedingly acute and fatal disease. Cases of this description have been recorded by Heresch, Goodhart, and Estlin Smith. The onset is sudden, with vomiting, colic, and fever, the latter usually not high; there is much straining at stool, followed by the passage first of fecal matters, later blood and mucus only. There is mostly some abdominal tenderness, and in some instances a purpuric or petechial rash on the skin. There is certainly the great depression and rapidly increasing weakness. There is often delirium at night. At the autopsy the last foot or so of the colon is found to be involved, and the changes are more marked in the cecum, but most of all in the sigmoid flexure and rectum. The mucous membrane is swollen and intensely injected with patches of thin membranous exudates, or if the child has lived some days there is ulceration of a superficial character. The etiology of these cases is obscure. They occur in the hot weather of summer, but their occurrence is not limited to this time. One of our cases occurred in April, at the height of an epidemic of influenza. (See below.)

In one case coming under our notice in a girl of twelve years, who was admitted to hospital under the care of our colleagues, Dr. Hutton, the attack commenced with vomiting and diarrhoea, followed by delirium, petechia on the skin, and bleeding from the nose. She was admitted to hospital on the sixth day of her illness in a collapsed condition, with a pulse of 120 and a temperature of 102° F.; she passed loose stools containing some hard lumps with blood and mucus; later, the epistaxis again supervened, the temperature rose to 104° F., and she died exhausted on the eighth day of her illness. The *post-mortem* showed the folds of the mucous membrane of the colon to be of an ashy-grey colour with well-defined ulcers varying in size from a pin's head to half an inch in diameter; all the changes were more marked below the sigmoid flexure.

In another case of a somewhat similar nature coming under our care the symptoms so closely resembled those of an invagination of the intestine, that an exploratory incision was made into the abdominal cavity. Cases of intussusception are not infrequently diagnosed as 'dysentery,' but it is rare for the opposite mistake to be made. The case was shortly as follows:

Acute Dis-collitis.—Death.—A boy of nine years of age was suddenly seized April 23, 1891 with pain in the summer stomach, which, followed by the passage of blood and mucus by the bowels; he continued in this way during the succeeding night. He was admitted to hospital next day, and, in spite of enemata and opium, he passed more stools, containing these entirely of blood and mucus. Temperature 99° F. April 24.—The temperature and bloody stools continued; in spite of large enemata of warm water, the latter brought away a small quantity of faecal matters. No answer could be got; the abdomen was not distended nor tender to the touch. Temperature 100° F. In the evening, at an operation which takes place, and the boy seemed rapidly sinking, a was decided to explore the abdominal cavity, in order to remove an invagination of the

lower of periton. This was done; but no improvement was found, only an intensely congested colon. Death followed about eight hours after. At the post-mortem the stomach and small intestine, so within twenty inches of the caecum, were found normal; the last foot or two of ileum was found congested, with patches of thin membranous exudation. The mucous membrane of the cæcum, sigmoid flexure, and rectum, was intensely injected, the changes in the lower parts being most marked, the rectum being hemorrhagic. There were patches of thin membranous exudation, but no ulcers.

These acute cases of dysenteric diarrhoea appear to occur in children of over eight or nine years rather than in younger children.

Diagnosis.—Tenesmus, with passage of blood and mucus by the bowel, in an infant under a year old, should certainly suggest intussusception rather than ileo-colitis; and a careful exploration of the rectum and palpation of the abdomen should certainly be made. In older children these symptoms indicate ileo-colitis rather than intussusception; fever, delirium, vomiting, also point the same way.

Treatment.—In acute ileo-colitis only the blandest food should be given, such as arrowroot, oat broth, or white of egg mixture, and if there is vomiting, the less food given the better. Hot fomentations containing opium should be applied to the abdomen, and every effort made to allay the inflammatory condition of the colon by small starch and opium enemata. Anything that can possibly irritate, such as purgatives or indigestible food, must be avoided, as likely to increase the peristalsis and tenesmus. Five to six ounces of warm starch mullage and boric acid with minimum of laudanum may be given to a child of ten years. Stimulants are certain to be required sooner or later. In mild or chronic cases irrigation of the bowel is often of the greatest service. Thin starchy mullage may be used with bismuth oxide or nitrate, and the amount employed should be sufficiently large to reach the caecum. Laxatives, as rhubarb and soda or castor-oil emulsion, are also useful. Great care must be taken in the diet, and all rich foods avoided.

CHAPTER VI

DISEASES OF THE DIGESTIVE SYSTEM—(continued)

Chronic Gastro-intestinal Catarrh. Gastro-intestinal Atrophy

IN some cases a gastric catarrh exists with but little evidence of the intestines being in any way affected, and in other cases the intestines may be the only part of the alimentary canal which appears to suffer; but in perhaps the majority of cases, especially in infants and small children, there is no sharply defined limitation between the two, the whole of the alimentary canal appearing to be involved.

The terms *chronic vomiting*, *chronic diarrhoea*, *simple atrophy*, *malnutrition*, *athrepsia*, are sometimes applied, according to the most prominent symptom which is present; thus, *chronic vomiting* is the most marked and striking symptom which may be present in catarrh of the stomach; diarrhoea is mostly present, or at least more or less looseness of the bowels, in the early stages of an intestinal catarrh, though the latter may exist without any marked diarrhoea, or in the later stages there may be constipation. If the only marked symptoms are dyspepsia and wasting, then the term *simple atrophy* has been applied. In all these conditions, while the symptoms may differ, the anatomical groundwork is the same—namely, a chronic gastro-intestinal catarrh, which in later stages passes into a gastro-intestinal atrophy.

Thus, an infant soon after birth, or perhaps when a few months old, suffers from repeated and frequent vomiting, or it suffers from diarrhoea, or if these are absent there are other chronic dyspeptic troubles, such as flatulence and colic; it fails to thrive and gradually wastes, and after a more or less protracted illness, during which the wasting becomes extreme, it de-cadaveres or is carried off by some intercurrent disease. In some cases the course is very short, perhaps only a few weeks, but in the majority the disease is chronic and the infant lives for months, suffering constantly from dyspepsia, unable to digest its food, finally dwindling away and dying at last. The less severe cases, especially if they come under treatment, gradually improve, and after months of the most careful feeding and nursing completely recover, though such cases usually become rickety or are otherwise weak. Recovery is only possible during the earlier stages; if the catarrhal stage has passed on into one in which there is advanced atrophy of the mucous membrane of the stomach and intestines with the secreting glands, recovery is of course impossible.

Experimental research has shown that there is a diminution in the amount of hydrochloric acid and pepsin secreted, while there is an excessive formation of mucus, lactic, acetic, and butyric acids. Much gas is given off from the decomposing food.

This gastro-intestinal atrophy rarely occurs in children over 18 months of age, and indeed is most common in infants under 6 months. Older children suffer from chronic intestinal catarrh, which rarely goes on to atrophy, though it is frequently the precursor of tuberculosis of the mesenteric glands.

In the majority of cases, chronic gastro-intestinal catarrh is the result of improper feeding. Infants who come of a healthy stock and are nursed at the breast of healthy mothers rarely, if ever, suffer from it, at least as a primary disease. It is the infants who are fed from the first on cow's milk or the various forms of starchy foods that chiefly suffer. The infant may go on fairly well for the first few weeks or more, suffering more or less from dyspepsia; then comes an attack of diarrhoea or vomiting, and forthwith it begins to go downhill; no food seems to suit it, however often changed, and it never recovers its digestive powers, which appear to have been hopelessly damaged. Some infants appear to get on fairly well till they suffer from an attack of broncho-pneumonia, or measles, or whooping-cough, which they survive only to begin gradually to waste. In some few instances, more especially in dispensary practice, atrophic infants may be seen of a few months old, who have been, according to their mothers' accounts, entirely breast-fed. In these cases the infants have been congenitally weak or premature, and very probably the mother's milk has been deficient in quality and quantity, or the child may have been fed whenever it cried, and in every way been badly cared for.

Symptoms.—Infants. The history which is generally obtained from such cases is that they were suckled for a few weeks or months after birth, then the mother had to go to work or her milk failed, and the infant was made over to a friend or hired to be artificially fed, and from this time it began to waste. On cross-questioning the mother or caretaker, it is found that it has been fed on topped bread or biscuits, because cow's milk did not appear to satisfy it, or it vomited the milk curdled, and it has constantly suffered from colic, vomiting, or more commonly diarrhoea. On the other hand, there is sometimes constipation, but this usually has been preceded by diarrhoea; the diarrhoeal symptoms being most marked in those suffering during the summer months. If the symptoms be analysed, three stages in the course of the disease may be recognised as first clearly pointed out and emphasised by Parrot, whose description of these cases under the name of *achrepsia* leaves nothing to be desired. The early symptoms or first stage are those of a simple gastric or intestinal catarrh, in the second the progressive wasting becomes the prominent phenomenon, and in the last stage the infant passes into an exhausted condition in which cerebral symptoms make their appearance. **First stage.** The infant suffers from a simple diarrhoea or looseness of the bowels; the stools, instead of being bright yellow and homogeneous, are liquid, thin, and often green in colour, or contain an excess of mucus; sometimes they consist almost entirely of striking curd, or remains of milk; the abdomen is distended with gas and remains constantly in this condition, the tongue is coated, and patches of aphthous stomatitis appear in the mouth. The infant

is restless, constantly whining, and will not sleep at night. Frequent vomiting may be a prominent symptom, the milk being returned curdled. The tissues become fatty, and then wasting commences. In the *second stage* all the symptoms are intensified and the characteristic wasting becomes manifest. The stools for the most part are loose and frequent, and consist of undigested food, being often pale and pappy-like, with a peculiar odour; at other times they are of a dark brown colour from the presence of altered bile. The infant is usually voracious, liquid food does not appear to satisfy it, and by the mistaken kindness of its friends it is fed with sopped bread or some thick food, a diet which has the great merit in their eyes of keeping it quiet for a longer time than liquid food or diluted milk; at times it cries incessantly, hardly ever appearing to sleep or only doing so for a short time unless under the influence of a 'soothing syrup' supplied by its nurse. The mouth becomes the seat of parasitic stomatitis, the skin is harsh and dry, small boils or a lichenous rash make their appearance, the hernia and genitalia are raw and excoriated. Its temperature is below normal, the feet and hands are congested, the face has a pallid earthy tint, and a sickly lactic acid smell is given out from the body, especially the abdomen. The wasting is extreme, the face being shrivelled, the skin wrinkled and hanging in folds about the thighs and arms. In the *third stage* the infant passes into a moribund state; it is too feeble to cry loudly, it becomes heavy and drowsy, taking little notice of anything. It becomes more and more emaciated, and death ensues, probably preceded by muscular twitchings, convulsions, or general convulsions.

If we analyse the principal symptoms of the disease, we shall find that sometimes one symptom, as diarrhoea, sometimes another, as vomiting, is the most prominent. In the majority of the cases there is more or less *diarrhoea* throughout the whole course, so that such cases would come under the category of **chronic diarrhoea**, or this chronic condition may alternate with the acute form. The stools at first are yellow, liquid and frothy, with foci of semi-digested curd; later they become green, the acid contents of the intestines acting on the bile pigments; when the diarrhoea has become chronic the stools are either liquid and of a dirty brown colour, or more often, especially if milk is being taken, they are white and semi-liquid, the bile pigment having disappeared, and they consist of decomposing food—undigested curd and mucus. Sometimes the stools consist almost entirely of mucus, the mucus membrane both of the small and large intestine secreting large quantities; the child is constantly passing stools of aqueous and undigested food.

In some cases **chronic vomiting** is the most troublesome symptom, there being no diarrhoea, but sometimes constipation. Cases of chronic vomiting with the consequent malnutrition are at times most difficult to deal with. So great is the irritability of the stomach that everything is rejected, either immediately after being taken, or after the lapse of perhaps half an hour. Diluted milk, peptonised preparations, meat juice, cream, and a variety of pansen foods are tried one after another, separately or mixed: each change only ends in disappointment, the infant becoming more and more wasted. Under such circumstances among the poorer classes the infant is given some thick food, as sopped bread or corn flour. Vomiting in many cases

appears to be the result of the rapidity with which cow's milk is coagulated in the infant's stomach and of the hard lumps of curd which are thrown down, this occurring even where the milk is reduced to one part of milk to five of water. In other instances it appears to be due to the rapid changes occurring in the sugar of milk, lactic acid being formed; the contents of the stomach are rejected, having a strong smell of sour and decomposing milk. In the catarrhal condition of the mucous membrane of the stomach much mucus is formed, while the gastric juice is weak, but its curdling power undiminished. Many such cases go from bad to worse, no food appearing to agree, all forms covering up alike. It must not be forgotten, in a case of constant vomiting, that it may be due to cerebral disease or some congenital defect. The prognosis in chronic vomiting is unfavourable if it commences in an artificially reared infant, and becomes thoroughly established, and is associated with progressive wasting.

As the child wastes the skin becomes rough and harsh and hangs in folds upon the limbs and trunk, and very frequently, as the oedema increases, the face, hands, and feet become oedematous. This oedema is due to anæmia rather than to any kidney complication. An erythematous rash is apt to make its appearance about the anus in those cases where there is much diarrhoea, and spread over the perineum and thighs. Small boils and abscesses are also common. Pemphigus may also appear.

The temperature is constantly below normal, often measuring 96° or 97° F. all through the twenty-four hours.

Complications.—Hæmorrhagæmia is very common. Tuberculosis of the mesenteric or mediastinal glands may occur, or there may be a more general distribution of tubercle throughout the body. It must be borne in mind that it is only in the more severe and neglected cases that intestinal catarrh passes on into atrophy; in the majority of cases the course of the disease is intermittent, sometimes better, at other times worse, and as the child grows older the symptoms of rickets become grafted on to those of a chronic catarrh of the bowels.

Older Children.—A chronic intestinal catarrh is not so serious a disease in children over two years of age as in infants, as it is rarely followed by an atrophic condition of the glandular apparatus of the stomach and intestines, but takes rather the form of habitual indigestion than anything else. It is, however, apt to be exceedingly chronic in its course and to be followed by various evil consequences, the most serious of which is tuberculosis of the lymphatic glands, or there is a constant state of health below par, which in itself is a source of danger. Chronic catarrhal affections of mucous membranes, either of the nose, mouth, respiratory tract, or intestines, are exceedingly apt to be followed by swelling and caseous degeneration of the lymphatic glands, with which the mucous membrane is connected. The intestinal lesion finds its origin for the most part in unsuitable food; the mucous membrane of the stomach and bowels is kept in a constant state of irritation by food which is too gross in quantity or of too indigestible character. Weakly children are especially apt to suffer, particularly those who are brought up in our large cities and whose time is spent either indoors or playing in the street. Children who suffer habitually from rhinitis, chronic tonsillitis, or chronic disease of the strumous type, are the chief

sufferers from chronic gastro-intestinal catarrh. It is very common in rickety children. Both the children of the well-to-do and of the poor classes suffer.

Symptoms.—There is habitual indigestion with perverted appetite, the child refusing its bread and milk and craving for 'tasty' bits from its parents' table, or altogether refusing its meals unless its food is highly seasoned; at other times the appetite is excessive. The abdomen is invariably rounded from the constant distension of the stomach and intestines with gas given off from the decomposing half-digested food. This distension is very frequently accompanied by more or less pain. The face is generally pale with dark areolæ around the eyes, fat is absorbed as the disease progresses, the muscles become flabby, and the emaciation of the child contrasts markedly with its large barrel abdomen. Such children have usually coated tongues, at other times the tongue is red and glazed, showing the enlarged fungiform papillæ more distinctly than usual and resembling the 'strawberry tongue' of scarlet fever. Sometimes the surface has a worm-eaten appearance, being coated with a thick fur except in irregular scrawny patches where the surface is red and glazed. The bowels are generally confined, the stools being frequently pasty with much mucus; there are apt to be incoincident attacks of vomiting and diarrhoea. There is very frequently more or less feverishness at night, especially in the subacute cases. Headaches are common, there is often restlessness at night, grinding of teeth, and night terrors. Sometimes when the disease is subacute, and there is some feverishness towards evening, the symptoms resemble mild typhoid fever and constitute what at one time was called 'infantile intermittent fever.' It is important to bear in mind that subacute intestinal catarrh may be present with an evening exacerbation of temperature as the principal symptom, and with no vomiting or diarrhoea. An intermittent fever during early childhood with no pulmonary symptoms is probably, if typhoid can be excluded, due to an excessive catarrh. It will not fail to be noticed that diarrhoea is a prominent symptom in the majority of cases of infants suffering from chronic intestinal catarrh, while in older children not only is the diarrhoea not present, but there is usually constipation. The explanation of this is perhaps not very clear, but it must be borne in mind that those cases where diarrhoea is present and excessive are more acute in character and run a more rapid course than those where the bowels are less irritable; there is also more likely to be diarrhoea in the early stages where the mucous membrane is congested, than in the later stages where the bowels have become more tolerant of irritation and the muscular walls wasted through long illness.

In some cases of intestinal catarrh, especially in those which complicate or follow whooping cough, there is an excessive formation of mucus from the intestinal walls; Dr. Emace Smith has called special attention to these cases under the name of '*mucous disease.*' The bowels are usually loose, the stools consisting largely of mucus, or an aperient may bring away large quantities of mucus. In the worst cases, when this form of disease complicates whooping cough, the prognosis is bad.

Diagnosis.—The disease most likely to be confounded with chronic intestinal catarrh is tuberculosis of the mesenteric glands, or the early stages of tubercular meningitis. During the first three or four years of life, it happens

very frequently that infants or young children are thought to have 'consumption of the bowels,' because they have ravenous appetites, 'pot bellies,' and have lost much flesh, when in reality they are suffering from a chronic intestinal catarrh. That the diagnosis is often difficult is only what is to be expected when it is remembered that an intestinal catarrh of more or less severity is the exciting cause of mesenteric tuberculosis; and in an advanced case, it may be quite impossible to say if a tuberculosis of the glands has supervened. Mesenteric disease is, however, much less common than simple intestinal catarrh, and is infinitely less so during the first six months of life than gastro-intestinal atrophy. Any evidence of tubercle in the lungs, or enlarged veins on the surface of the abdomen, or the detection of rounded masses by palpation in the abdomen, would favour a diagnosis of mesenteric disease. In older children the fact that those suffering from intestinal catarrh grind the teeth, are restless at night, are subject to night terrors and headaches, is sufficient for most parents to become alarmed, fearing that the child is commencing with tubercular meningitis.

Microsc. Anatomy.—*Chronic Gastro-intestinal Catarrh.*—In the early stages there is swelling, and injection of the mucous membrane of the stomach, and small and large intestine. The surface is grey, streaked with red, and there is an excess of mucus; the changes are usually most marked in the ileum and colon, especially about the sigmoid flexure; in these places the solitary glands are enlarged, the mucous membrane is raised in folds, and often much injected, and follicular ulceration may be present. The microscopical appearances somewhat resemble those already described in acute catarrh. The surface of the mucous membrane of the stomach is covered with masses of leucocytes and mucus embedded in mucus. The capillaries are everywhere distended, the gastric glands are separated from one another by columns of leucocytes effused between them, the whole mucous membrane is swollen, and the muscular layer thickened.

Similar changes are seen in the intestines, leucocytes are present in large numbers in the submucosa and between Lieberkühn's glands, the latter are compressed and finally disappear, so that in places only masses of round cells are seen taking the place of the glands. A stage of atrophy succeeds that of chronic catarrh, and the appearances presented are those of a wasting of the mucous membrane, and a destruction of the secreting glands. The chronic swelling of the mucosa, and infiltration with leucocytes, have led to a wasting and cicatrization of the tubular glands; but death usually takes place before this stage is reached.

In *infantile atrophy* the stomach and intestines are distended with gas, the former is frequently dilated, the mucous membrane is everywhere pale, the intestines are thin and translucent. This is especially marked in the more advanced cases, the intestinal walls are exceedingly thin, the solitary glands and Peyer's patches are wasted and have almost disappeared, with perhaps brownish spots or streaks where minute hemorrhages have taken place. These appearances will be varied with those of chronic catarrh according to the amount of atrophy that has taken place. The microscopical appearances show the mucous membrane of the stomach to have undergone wasting, being reduced to perhaps one-quarter its normal thickness. The gastric glands in places have completely disappeared, in other places they are

compressed and partly destroyed by round-cells and young connective-tissue fibres. In the small intestines the appearances will be those of chronic catarrh, or those with the addition of destruction of the glandular apparatus. The tubular glands in places have disappeared, or are compressed or dilated by a connective-tissue growth, villi have completely disappeared, or only their remains are present, the solitary glands are atrophied or have disappeared. Similar changes may be found in the colon. Parrot has described various other lesions in the alimentary canal of infants dying within a few weeks of their birth; such as a spread of the parasitic growth from the mouth to the stomach and intestine, usually the caecum. The same author has found minute circular ulcers in the stomach, from which hæmorrhage has taken place, less often larger and irregularly shaped ones; he has also seen the mucous membrane of the stomach to be the seat of a diphtheroid exudation. In the later stages, when the blood is profoundly altered, thrombosis of the renal veins, pulmonary veins, or sinuses of the brain may take place. Fatty degeneration (imitation of Parrot), softening, or meningeal hæmorrhage, may take place in the brain. The kidney may be the seat of toxic and infarcts.

Treatment.—The treatment of chronic gastro-intestinal catarrh in *infans* consists principally in careful feeding; the blandest and least irritating forms of food must be selected, while frequent weighings of the infant should be resorted to in order to ascertain if any progress is being made. In *infans* under four months a wet nurse should be obtained if possible. Where there is much diarrhoea, milk must be used sparingly or altogether omitted for a while, as the hard curds formed in the stomach are beyond the digestive powers of the weakened stomach and intestines. Small quantities of whey and barley water, white of egg and barley water, or the juice of an aspidistra (dop) may be given at short intervals during both day and night. Improvement having taken place as regards the diarrhoea, milk in some form or other must be given. Some of the forms of sterilized milk already referred to (p. 51) may be used alternately with raw beef juice and some grained food such as Mellin's, and the cream mixture referred to (p. 45) may also be tried. Peptonized milk is often of much value under these circumstances, when made by adding 3*ss.* of boiling decoction of arnice root with 3*ss.* of cold milk, adding two teaspoonfuls of cream, half a peptonizing powder (Beuge), sweetening, and giving it to the infant after it has stood for fifteen minutes. Every care must be taken that the feeding bottle is clean, and the food prepared with the most scrupulous care. Whenever the weather permits, the infant must be taken into the open air as much as possible. The medicines given must be selected according to the most prominent symptoms. If the stools are loose, contain much mucus and curd, and are foul or stinking, small doses of castor-oil emulsion or calomel should be given, to be followed by bismuth and small doses of opium. If the stools are dark brown or yellow and very liquid, astringents in the form of extract of logwood, catechu, or pomegranate will be of most service, especially if small doses of opium are given by the bowels. If the diarrhoea approach the dysenteric type, much mucus and blood being passed with straining and forcing down, enemata of nitrate of silver and opium and alum or vegetable astringents will be useful. (F. 12, 13, 14.)

The treatment of chronic gastric catarrh in infants when it has become confirmed is very often extremely discouraging.

In the milder forms of vomiting the importance of diluting the milk so as to reduce the quantity of curd, or of peptonising the milk to gain the same end, must be insisted upon. It is also of much importance not to give food too frequently, but to give the stomach a complete rest for several hours. In several cases in which milk or whey, in whatever form it is given, returns sour and curdled in a few minutes, other food must be substituted at least for a time. In such cases Mellin's Food, either made with water or weak real broth (half a pound to the pint), may be given; the bottle being discontinued and the infant fed with a spoon. Instead of veal broth, raw meat juice or 'liquid meat' may be used. After a few days, milk may be again tried, or small quantities of cream may be added to the Mellin's Food in lieu of the meat juice. In this acid condition of stomach small doses of sodii bicarb. and pepsine are often very useful. (F. 15.)

In **older children** careful dieting is of the utmost importance, and the first difficulty encountered will probably be that the child has been over-indulged and so spoilt by its parents that it is difficult to get it to take a carefully selected and restricted diet. In arranging a diet it must be borne in mind that the child should take only such quantities as the impaired state of the digestive powers can deal with, any excess being liable to undergo decomposition in the intestines, and give rise to flatulence and other troubles. It is also most important to give the stomach a complete rest during the intervals between meals; sweet biscuits taken during the morning or a run on the kitchen at frequent intervals during the day are fruitful sources of chronic indigestion, and the plainest and most compulsory directions should be given to the parents by the medical attendant that nothing whatever should be taken except at regular meals. If the child refuses or only half gets through its breakfast, this should by no means be supplemented by a second edition in the parents' table, or aasty lunch to make up for the morning's deficiencies. It is wiser by far, if the breakfast is but half taken, to let the child wait till the next meal; a little starvation can do no harm, at any rate much less than over-indulgence and the formation of bad habits. The importance of fresh air and change of scene in cases of habitual indigestion can hardly be over-estimated. The worst form of exercise is a 'constitutional' taken with the nurse or governess; outdoor games of various kinds, gymnastics, riding, or driving, or some form of recreation which will occupy the mind and give an interest to the exercise, are far preferable to any dull routine. A change to the seaside, or some bracing elevated inland site where there is a keen cool air, will often work wonders in these cases. It must, however, be remembered that such cases are often worse, or there is no improvement, at first; children when first removed to the seaside are apt to do too much and eat too much; they are over-tired and restless at night, and attacks of dyspepsia or perhaps excretion or other eruptions occur. A caution is often necessary to prevent this.

It is wiser in most cases to lay down a complete diet chart for the guidance of the parents, though a certain latitude must necessarily be permitted on account of varying tastes. The following diet tables may be taken as samples, which can be modified according to circumstances.

Diet for a child of 5 to 7 years, indigestion not severe:

Breakfast, 8 A.M.—A breakfast cupful (8 oz.) of bread and milk, made from whole meal bread; a teaspoonful of malt extract may be added; this may be followed two or three times a week by the yolk of a lightly boiled egg on slices of toast, or a piece of toast and dripping or bacon fat.

Dinner, 12 to 1 P.M.—A broiled mutton chop, *finely seasoned*, or fresh white fish, with mashed potato, spinach, or French beans; to be followed by gruel, rice pudding or a baked apple. Milk to drink.

Tea, 4 to 5 P.M.—A cup of cocoa and milk, with toast or stale bread.

Supper, 7 P.M.—A cup of beef tea or mutton broth.

In the more severe and protracted cases it is well to avoid farinaceous food as much as possible, as recommended by Dr. Eustace Smith.

Breakfast, 8 A.M.—Half to three quarters of a pint of fresh milk, acidified by twenty drops of the saccharated solution of lime; a slice of toast with yolk of egg, or fresh fish.

Dinner, 12-1 P.M.—A small mutton chop or boiled sole, a thin slice of stale bread, with half to a wineglassful of sherry or bitter beer, well diluted.

Tea, 4-5 P.M.—Same as breakfast.

Supper, 7 P.M.—A cup of beef tea.

In some of these cases of chronic dyspepsia, especially where the stools are pale, the amount of milk which the child takes must be lessened in quantity—the milk given being much diluted with cocoa, or peptonised milk may be given.

In all cases of habitual indigestion it is of much importance to sponge every morning with cold or tepid water (60°-70°), keeping the child's feet in warm water during the process, if it is subject to cold feet or has a sluggish circulation. A shower bath is often of much service. After the morning's bath friction with as rough a towel as the child's skin can stand should be used. The child's dress should consist of woollen garments next to the skin, and every chance of getting cold should be avoided.

The medicines which are of the greatest value in these cases are mucic acid in combination with balahe and pepsine (apoc. to. apoc. of the L.), or eucalypta and pepsine may be given.

Arsenic is often of much value, but requires to be given in increasing doses to bring out its full value. For a child of seven years, three-drop doses may be given, and gradually increased to six drops, or it may be given in small granules, which are readily taken by children, preferably an hour after food. At the same time it is well to order a saline purgative, which will keep the bowels relaxed rather than loose.

Alkalies with aconit or rhubarb are often prescribed with much advantage (F. 16, 17, 18.)

Later, when convalescence is established, acids and bitters should be given.

If the bowels keep constipated, a small granule containing half a grain of aqueous extract of aloes may be taken at dinner time daily; in many cases 2 grains will be required to keep the bowels well open. This may be supplemented, especially if the stools are pale, by an ounce or two of Benger's water, to which an equal quantity of warm water has been added, to be taken two or three times a week before breakfast, or Rhusat or Friedrichshall

water, half a wineglass to a wineglassful in warm water, or a teaspoonful of effervescent Carlsbad salts, may be taken before breakfast two or three times a week, and decreased or increased according to the state of the bowels.

Dilatation of Stomach.—Dilatation of the stomach during infancy is commonly the result of a long-continued gastric catarrh; in rare cases it is secondary to a congenital stricture of the pylorus or duodenum, or upper part of the small intestine. In the majority of cases the dilatation takes place rapidly, as in acute gastric or gastro-intestinal catarrh, or in 'cholera infantum,' but it is far more frequently found in weakly infants or children who have suffered for months from chronic dyspepsia and who are probably anæmic andrickety. It is easy to understand that, if the digestive fluids are weak and insufficient to properly digest the food, the curd of milk and sugars decompose in the stomach, and gases are given off in large quantities. The constant distension of the stomach keeps the muscular walls on the stretch, the muscular fibres become thin and atrophic, and the distended



Fig. 14.—Waxen preparation of stomach, from an infant of five months. (Dilated state.)

condition tends to become permanent. The muscular mucous membrane, including the glandular elements, is wasted. The effect of a dilated stomach is to add to the dyspeptic troubles: the a dilated and powerless bladder, its contents become stagnant and decompose; it never thoroughly empties itself, but always contains much mucus and decomposing curd of milk. These dilated stomachs sometimes reach an enormous size. Heischel records a stomach of an infant two weeks old with a capacity of 750 cc. (normal, 70 cc.); an infant of three months with a stomach of a capacity of 485 cc. (normal, 150 cc.); another of four months, of 700 cc. (normal, 180 cc.); and another of ten months of 850 cc. (normal, 300 cc.). The symptoms are not very definite, and we have on several occasions discovered *post mortem* a considerably dilated stomach, which we had not detected during life. There is chronic dyspepsia, discomfort after food, distension of the stomach with gases, coated tongue, and in some cases chronic vomiting. The diagnosis may be difficult; in some cases the limits of the dilated stomach may be mapped out by percussion, but this can only be done if the colon and small intestine are not distended. If the colon is

much distended, it will probably be impossible to distinguish between the tympanic note produced by percussing the stomach and that produced by percussing the colon. A splashing sound may sometimes be produced by shaking the child, in cases of dilated stomach, if there is much fluid in the stomach. The prognosis is not necessarily bad, as there can be little doubt that under favourable conditions the stomach may recover itself. The treatment is that of chronic dyspepsia—washing out is especially useful.

In rare cases there is a congenital stenosis of the pylorus with a secondary dilatation and hypertrophy of the walls of the stomach. Two cases are recorded by Hirschsprung;¹ one of these cases lived a month, the other six months; the prominent symptoms were vomiting, constipation, and progressive wasting. At the *post-mortem* in each case the pylorus was thickened, the opening stenosed so as only to admit a needle-sized sound, and the stomach dilated and the walls hypertrophied. Hirschsprung relates two somewhat similar cases.²

Dilatation of the stomach, sometimes extreme in degree, is present in congenital obstruction of the duodenum and ileum. (See p. 141.)

Malformations of the Stomach.—These are certainly uncommon, but a slight degree of hour-glass constriction which had been unsuspected during life may at times be found at *post-mortem*. In a case of our own in which we made the section, but did not see the infant during life, there was a well-marked constriction in the central portion of the stomach. (See fig. 14.) There was a history of constant vomiting during life.

Carcinoma of the Stomach.—New growths in the alimentary canal are exceedingly rare in early life. The best-known case is that recorded by Dr. Collingsworth. In this case a colossus epithelioma was found in the stomach of an infant of five weeks old. We have met with one case, but the new growth was more duodenal than gastric. The case was shortly as follows:

(Liver 11, aged 16 years, was referred to hospital Sept. 1, 1895. He was a thin, fair, well-developed child, and symptoms of cancer. There had been no vomiting, pain, or hæmorrhage. The abdominal distension was considerable; the walls of intestines could be distinctly seen through the abdominal walls. There was no ascites, and no tumor could be felt. He was discharged February 21, 1896, somewhat improved, having milk back during his stay. He was readmitted April 23, 1896. The abdomen was distended and tender, and a tumor could be felt below the ribs at the liver, to the right of, and about the same level as, the umbilicus. There were frequent attacks of severe colicky pain. He gradually emaciated, and died May 13. The *post-mortem* showed that the transverse colon near the hepatic flexure, the duodenum and ascending colon were united, the stomach was dilated and its walls thickened. The pyloric opening was obstructed by the duodenum; on the cardiac side of the pylorus were two small growths, the size of peas; on the duodenal side there was an elongated cavity, the walls of the larger part of the duodenum having been destroyed by a new growth; lower down were some polypoid-looking growths; below these the mucous membrane was normal. Microscopical examination showed the growth to be a colossus epithelioma.

Ulcer of Stomach.—Tubercular ulcers of the stomach occur in children, but we have never seen an example. When puberty is passed simple ulcers may occur. We have known severe hæmorrhages occur from ulcers in the jejunum.

¹ *Lehrbuch für Kinderärzte*, Band xxvii. Heft 1.

² *Lehrbuch für Kinderärzte*, Band xli. Heft 1.

Intestinal Worms

The worms which most commonly infest children are the thread worms, round worms, and tape worms, of which the former are the most common.

Thread Worms (Oxyuris).—These trichostrongyle pests inhabit the lower bowel, mainly cæcum, colon, sigmoid flexure and rectum, and also the vagina, an unhealthy state of the mucous membrane with sluggish bowels appearing to favour their development. To the naked eye they appear like short



Fig. 11.—Oxyuris vermicularis, female. Highly magnified. Quain's Dictionary of Medicine.

pieces of white thread: under a low power the females, which are the most numerous, are seen to taper at each end, and their interior ducts will be seen to contain numerous oval-shaped ova, some of the tubes containing embryos. These parasites gain entrance into the system by the ova being taken in the food, or perhaps more frequently by means of the ova adhering to the fingers of those already affected; they are thus conveyed directly or indirectly to others. The extreme fertility of these worms makes it certain that anyone who is affected with thread worms and is not of scrupulously clean habits will have ova adhering to the neighbourhood of the anus which may be transferred by the fingers to the individual's own mouth or to others. The symptoms are very uncertain, the diagnosis being usually made by the patient's friends detecting the parasites in the chamber vessel used by the child. The most common symptom to call attention to

the presence of thread worms is the irritation and itching which they are apt to give rise to at the anus or entrance to the vagina. Girls will suffer from excessive discharge of mucus from the vagina, sometimes containing blood, from the presence of oxyurias in the vagina or the result of scratching. In many cases the presence of thread worms seems to give rise to no symptoms whatever.

Weakly anæmic children with sluggish bowels are most often affected. The treatment consists in expelling the worms, preventing their re-entrance, and in improving the health of the child so that it is less likely to provide favourable cultivation ground for these unwelcome guests. The first indication is best



Fig. 12.—Eggs of Oxyuris vermicularis, showing embryos. Quain's Dictionary of Medicine.

fulfilled by a sharp purge to expel or else to drive them into the lower bowel, to be followed by enemata to destroy those present in the colon and rectum, and wash away any excess of mucus present; a grain to two grains of calomel, in combination with two or three grains of resin of scammony, may be given to children of three to eight years of age overnight; and the following evening, if the bowels have been well acted upon, an enema of infusion of quassia as large as can be given should be used. It will be well to repeat the enemata every other evening for a week or two. Great care should be exercised to see that the child is washed about the genitals with soap and water after each stool to prevent reinfection. Injections should be used repeatedly to

free the vagina from any of these worms, if there is any vaginitis or irritation. Weak cathartic and lotions will answer very well, and some dilute red oxide of mercury ointment (v. 3) may be smeared at the entrance to the vagina. The general health of the child must also be thought of and a careful diet prescribed, excess of sweets and starches being avoided. If constipation exist, Rukhat or Huzjahi water should be given every other morning before breakfast, in sufficient quantity to produce a soft stool without purging; sulphate of iron, gr. $\frac{1}{2}$, with spirits of chloroform and orange flower water, twice a day, is often very useful. Cod liver oil in selected cases is of great service.

Round Worms (*Ascaris lumbricoides*).—The common round worm measures from four to twelve inches in length, the females being somewhat longer than the males; they are reddish white and have more or less resemblance to common earth worms. They mostly inhabit the small intestine, but are apt to wander into the stomach, large intestines, or even into the gall bladder. Several may exist in the intestine at the same time, in exceptional instances many hundreds may be present. They gain entrance into the system by means of their ova, which are swallowed with the food; the shells surrounding the ova are dissolved by the gastric juice, setting free the embryos. The symptoms produced by the presence of round worms cannot be certainly distinguished from those of dyspepsia or intestinal catarrh, with which the ascariides are so commonly associated. The passage of a round worm per rectum is often the first thing to call attention to the subject; on the other hand, mothers often dogmatically assert that their child has worms because he 'picks his nose' and his food appears to do him no good. The latter symptoms, it is needless to say, are not diagnostic of the presence of worms, but of an unhealthy state of the alimentary canal. The presence of one or two round worms rarely produces any symptom *per se*, unless they pass into the stomach or bile duct. In larger numbers they may give rise to colicky pains, especially at night; diarrhoea, vomiting, and symptoms of obstruction of the bowels have occasionally resulted. In rare instances worms have found their way into the peritoneal cavity and been discharged with the contents of an abscess through the abdominal wall. The treatment is not as difficult as the diagnosis. Santonin combined with calomel or castor oil should be given, and is almost certainly successful after a dose or two has been given. Santonin, gr. $\frac{1}{4}$ – $\frac{1}{2}$; calomel, gr. $\frac{1}{2}$; may be given overnight, and some fluid magnesia or other saline next morning before breakfast. Or the santonin dissolved in two or three teaspoonfuls of castor oil may be given before breakfast. The santonin may be repeated once or twice, but not often, until the physiological effects (if any have been produced) have passed off. If the santonin cause vomiting, smaller doses should be tried or compound scammony powder substituted.

Tapeworms are as common in children as in adults, both the *Tænia saginata* and *T. medicanifolia* being found. Infants and young children less often act as hosts for tapeworms, but they have been found in infants under a year old. Attention is first called to the fact by the passage of the joints or proglottides in the stools. Older children will often complain of pain in the epigastrium, and peculiar movements are felt inside; they are apt also to lose flesh and suffer from various dyspeptic symptoms. The difficulty

of dislodging the greater part of the coarctum is not great, but the head is not so easily expelled, especially that of the *Tinaria infusa*. The success of the treatment by means of the administration of male fern depends upon the intestines containing as little food as possible. A dose of castor oil should be given overnight sufficiently large to act freely before morning; twenty to thirty drops of ethereal extract of male fern (freshly prepared) should be given in half an ounce of maceilage and water before breakfast; breakfast should consist of some light refreshment such as beef tea; at noon another dose of castor oil should be given, which will act in the course of the day, bringing away the intruder. Careful search should be made for the head, bearing in mind that the joints are likely to break about an inch from the head, that the latter is about the size of a large pin's head, and the thickness of the worm itself near the head is only that of a steel thread.

If, after careful search by a competent observer, the head is not discovered in the stools, after a few days the treatment may be repeated, but it is not wise to continue to repeat the male fern, as toxic symptoms are apt to arise. Decoction of porregrate root may be substituted if it is necessary to continue the treatment.

Ascites.—Fluid is sometimes present in the peritoneal cavity of the child without dropsy elsewhere, and it may be difficult to decide as to its cause. The diagnosis of ascites when it forms part of a general dropsy, as in cardiac disease or renal disease, is easy and does not call for special comment.

An ascites which is primary in a child is usually the result of some lesion of the peritoneum, as chronic peritonitis, or the result of partial obstruction such as intussus or perihepatitis. The detection of a large or moderate quantity of fluid in the peritoneal cavity is not difficult, the percussion note being dull in the flanks, while the region round the umbilicus is tympanitic in consequence of the distended intestines floating upwards when the patient is lying on his back; change of position on to the side will float the intestines to the highest point, and the flank which is uppermost will now be resonant. While change of the patient's position will thus cause the fluid to gravitate to the lowest point if it is free in the peritoneal cavity, it must be borne in mind that in chronic peritonitis there may be a matting together of the intestines which prevents them from floating upwards, and consequently there may be no alteration in the percussion note after change of position. The amount of dullness on percussion may vary from day to day according to the varying distension of the intestines. In ascites the superficial veins of the abdomen are usually enlarged, the skin becomes shiny and stretched if the fluid is excessive, and often the umbilicus is protruded and pouched out, containing fluid which can be pressed back into the abdominal cavity. The detection of a small quantity of fluid in the abdomen is difficult, especially when the intestines are much distended with gas and the large bowel is loaded with faeces, the latter giving a more or less dull percussion note in the flanks. Flaccuation may be felt by passing the finger into the rectum; fluid may thus be detected in the pelvis. A careful observer is hardly likely to mistake simple distension of the intestines with gas for ascites; the thrill imparted to the contained fluid by gently tapping the flank is absent in the flaccid distension, and on percussion the abdomen is universally tympanitic. The

diagnosis of the cause of the ascites is often difficult, as a large accumulation of fluid may be due to chronic peritonitis and closely resembles an ascites due to portal obstruction. Chronic peritonitis may be quite unaccompanied by pain or tenderness free in the last, and the fluid may be excessive. Any swelling or induration of the osseum or intestines to be felt through the abdominal wall, or a slight evening rise in the temperature or signs of tuberculous elsewhere (as in the testis), or chronic diarrhoea, would be in favour of chronic peritoneal tuberculosis. A normal temperature, the ascitic fluid freely movable, the general health good, slight jaundice or bile pigment in the urine, would be in favour of portal obstruction, as cirrhosis or melancolicity. If the fluid is localised by the presence of adhesions, and does not occupy the whole peritoneal cavity, it is probably due to tuberculosis. The possibility of hydatids of the peritoneum must be borne in mind.

CHAPTER VII

DISEASES OF THE DIGESTIVE SYSTEM—(continued)

Acute Peritonitis

ACUTE general peritonitis is not an uncommon disease during infancy and childhood. It occurs as a primary disease, and also spreading from some other part or originating in consequence of the leakage of the intestinal contents into the peritoneal cavity, or it may follow a blow or kick on the abdomen. This form also suffers from peritonitis perhaps more violently than acute, and the adhesions which are left surrounding and matting the intestines are apt to interfere with the growth and development of the gut, and lead to stenosis or obstruction by narrowing the bowel or tying it up in coils. Acute peritonitis occurs in the newly-born, secondary to atresia or megacæcitis; but such cases are rare in private practice. Apart from these cases, peritonitis is not common in infants and young children. Dr. West mentions a case of idiopathic peritonitis occurring in an infant of seven months, which proved fatal in six days; the attack was sudden, accompanied by vomiting and abdominal distension; after death, lymph and serum fluid were found in the abdominal cavity. We have known it in infants and young children to spread from a suppurating mesenteric gland. Acute peritonitis occurs in older children by no means infrequently, supervening, without known cause, in the midst of apparent health. Sometimes cold or a more or less severe blow appears to be the starting point. At the *post-mortem* there is nothing to indicate where the inflammation commenced. Not infrequently the peritonitis is the result of some lesion in the cæcum, vermiform appendix, or mesenteric glands. It sometimes occurs in tubercular subjects: thus a phthisical boy of nine years old was suddenly seized with pain in the abdomen and vomiting, and died in ten days; at the *post-mortem* an acute general peritonitis was present, and also adhesions from old peritonitis and some calcified mesenteric glands. Acute peritonitis may be caused by the spread of inflammation from other parts, as from the pleura, an empyema bursting through the diaphragm, from the pericardium, ulcer in the stomach, duodenum, ileum, or cæcum, or from intussusception. It may occur in the course of typhoid fever from perforation of the intestine and extravasation of faeces. It is rare in the course of scarlet fever, but it is not uncommon in the last stages of the succeeding nephritis, when uræmic phenomena have set in; it is then mostly of a purulent character. We have seen peritonitis *post-mortem*, which appeared to have succeeded to or been associated with an acute intestinal catarrh, with symptoms of an inflammatory diarrhoea or an intestinal ulcer; and it seems

probable that, in some cases, the peritonitis may be secondary to an intestinal lesion.

Symptoms and Course.—The symptoms of acute peritonitis in the infant and child are by no means always as characteristic as they are in the adult, and cases will sometimes occur where extensive peritonitis is fatal at its first outbreak which was not suspected during life, especially when superimposed in the course of some other disease.

The attack usually begins with vomiting, sometimes diarrhoea, and great pain and tenderness in the abdomen referred to the region of the umbilicus; the amount of tenderness on pressure varies even in cases where no opium has been given, and where the patient is under the influence of this drug pain may be entirely absent. Constipation after the onset is a marked feature when the attack is completed, no faeces and often no wind passing by the bowel; the vomiting is constant, the distension of the bowels very great, so that the coils of distended small intestines may be seen through the abdominal walls, and the case may readily be assumed to be obstruction of the bowels from some mechanical cause. Though no complete obstruction exists, yet the coils of intestine are seen *four over five* to make sharp turns on one another, 'kinks' being formed, which, with the layers of lymph on their surface, must seriously impede the passage of their contents. The paralysis of the muscular coat of the bowel, by diminishing or arresting the normal peristaltic movements, further prevents the onward movement of the intestinal contents. The vomiting is mostly constant as long as food is given; undigested food, bile and sour-smelling intestinal contents may be brought up, but the vomited matters are never fecal as they are in *typhus* or *intussusception*. There is usually moderate fever, the temperature being 101° to 102° F., but a normal or subnormal temperature may persist throughout the case, and distension is not always present.

In the later stages the abdominal distension is often extreme, the coils of distended intestine are prominently discernible through the walls of the abdomen, the face becomes puffed and blue, the pulse quick and thready, and the patient dies collapsed, often suddenly at the last. While this is the all but universal ending of a case of general peritonitis, when the symptoms have fully declared themselves, cases undoubtedly occur in which the diagnosis of peritonitis is made, on account of the distension and pain in the abdomen, which gradually improve under treatment, and finally recover. There is reason to suppose that cases of acute peritonitis will occasionally get well, even when the attack has been a general one. In other cases the symptoms of a local suppuration, hectic, local tenderness, and swelling, succeed to those of a general peritonitis. In such cases, however, there may have been a local peritonitis from the first.

The following cases will illustrate some of the above remarks.

Acute Suppurative Peritonitis.—John C., aged 7 years. The family history was good. He had been a strong boy up to the time of his fatal illness. No cause could be assigned for his sickness. Four days before admission to hospital he complained of pain in the 'middle'; there was vomiting and constipation. On admission to hospital on the fifth day of his illness, the face wore an anxious expression, as if he was in pain; the abdomen was distended and tense, and tympanitic and tender to the touch; his legs were drawn up; he constantly vomited dark, sour-smelling, almost fecal stuff. The vomit, drawn off by a siphon, contained albumen. All food and drink by the mouth was

stopped, and he was given enormous doses of opium, and every second hour till three o'clock had been given. He passed a restless night, yet was slowly free from the effects of the opium. He gradually sank, dying on the evening of the sixth day of his illness. At the *post-mortem*, on opening the abdomen, a few ounces of effusion was escaped; the surface of the intestines was injected; the bowels were matted together with lymph; there was no strangulation. The caecum and vermiform appendix were normal; there were patches of intense congestion on the mucous surface of the ileum, and a sharply cut ulcer (not perforating) half an inch in diameter, some two feet above the caecum. No certain cause for the acute peritonitis was found, unless it be assumed—which is indeed not improbable—that an ulceritis existed in the first instance, and that the peritonitis was secondary.

In the following case the symptoms clearly resembled acute obstruction of the bowels from strangulation:

Acute General Peritonitis.—John C., aged 9 years, was healthy up to February 9, when he was injured by a blow in the abdomen; but the injury does not seem to have been very severe. He complained of pain in the belly, and vomited the same evening. He continued to vomit five or six times a day till his admission to hospital (under Dr. Thorne) on the fifth day of his illness. He had passed nothing per anum except a small stool after an enema, and it was supposed he was suffering from an intussusception. On admission his face was flushed, the eyes swollen; the abdomen was highly distended, the walls of abdomen being plainly seen. He complained of paroxysms of pain in the abdomen. He vomited fecal matter shortly after admission; there was pain on deep palpation in the right iliac fossa, but no marked tenderness. Full doses of opium were given. The next day (the sixth of his illness) it was thought advisable to make an exploratory opening into the abdomen (which was done by Mr. Wright); the intestines were deeply relaxed, and turned together with lymph; no constricting band or strangulation was detected; the wound was closed and a drainage tube inserted. The boy gradually sank, and died suddenly the next day. At the *post-mortem* a general acute peritonitis was found; no cause for it was made out after a careful search.

In the following case, related by Sarré,¹ acute peritonitis was accompanied by diarrhea:

Acute Peritonitis: Diarrheal.—A boy of 12 years, who had always enjoyed good health, was seized with shivering and headache. On the third day he had diarrhea, and pain in the abdomen, followed by vomiting, distension of the abdomen, and great tenderness; the vomiting continued, so that not only bile but also the contents of the small intestines were ejected. Death took place on the fourth day. At the autopsy a general suppurative peritonitis was found, without any other lesion.

In the following case the peritonitis was secondary, occurring in the course of scarlatinal nephritis.

Acute Nephritic Peritonitis.—Nora W., aged eight years, was attacked with scarlet fever, the initial symptoms being vomiting, high fever, and rash. She was admitted to hospital on the third day. The bowels were sluggish; there was much glandular enlargement and high fever. The temperature varied from 102° to 103° F. till the seventh day, when it reached 102 1/2° F., and a sense of alleviation appeared in the urine. On the thirteenth day the temperature was 104° F., and only two hundred and fifty cubic centimetres of urine were passed. From the fourteenth to the sixteenth day the urine passed was only from seventy to one hundred cubic centimetres daily; some contained fibrinous and epithelial casts. Eighteenth day, vomiting, temperature 104° F.; only seventy cubic centimetres of urine. Nineteenth day, no urine passed; severe abdominal pain, respirations shallow and thoracic, abdomen distended and tense. Twentieth day, temperature 98° to 99° F., patient collapsed. Twenty-first day, death. At the autopsy a general suppurative peritonitis was found; pieces of left lung; some glomerular nephritis.

1 Barthez et Sarré. *Traité des Maladies des Enfants*, vol. II, p. 469.

Case Peritonitis.—Boy, 12 years, said to be delicate, but never ailed anything. He played with his brothers on Wednesday afternoon, tumbling about on the floor—no definite history of a blow. Thursday he did not eat his breakfast, and said he felt sick; vomited several times during the day, and was thought to be upset from a disordered stomach. Friday morning vomited, and in much pain; bowels acted slightly; not much distress; child died same evening, 6 P.M.—*Post-mortem, Monday, July 20, 1880.*—Some distension; omentum normal; surface of small intestine intensely injected, most marked below umbilicus; some lymph, not prominent generally; stomach versus liver not adherent; a few oment. in pelvis. Vermiform appendix; serosal surface injected; no evidence of past inflammation. Slicing up of intestine showed them to be normal, except the lip of the ileo-caecal valve, which was injured; the appendix was thickened and congested, and contained some mucus only. Lungs were normal; heart also normal; the fluid dark and fluid, and there were small extravasations of blood on the surface of the liver. In this case the boy died in ten days from acute peritonitis. No cause could be assigned, unless it resulted from a blow while playing with his brothers the day before he became ill. There was no bruising of the abdominal wall.

In the following case the cause of the peritonitis was doubtful, but there is no doubt it was very extensive, and it is a good illustration of the value of operation even in extreme cases. This boy was dirty and so ill that it hesitated to operate at all.

Acute Peritonitis. Operation, Recovery.—Tom A., aged 124. Six weeks before admission was kicked by a horse in the right side of the abdomen. He was apparently not much hurt, and was allowed by his doctor to get up on the following day. Two weeks after the accident, on May 27, 1884, he had slight abdominal pain, supposed to be due to riding a cucumber. Vomiting and pain soon followed, and tenderness in the right side began a day or two later. The pain spread upward, vomiting increased, and intense tenderness appeared in the left hypochondrium, with colic. He was admitted on June 4. At that time he looked very ill; anxious face; pulse small; abdomen full, more very little with respiration; legs raised freely; abdominal walls rigid, tenderness most marked on left side; nothing specially to be felt on right side. A few hours later, face dusky and blue; rectal examination revealed greater tenderness on the left side than on the right. The abdomen swelled up in the middle line below the umbilicus, and a large quantity of fecal gas escaped. The abdomen filled up far left than right, and appeared circumscribed, but there was resistance in the right side also. He gradually improved; the quantity of gas escaping from the tube and in large amount, and though he vomited there was tenderness in the right side again, he steadily got well, and was healed in good health one or two months later.

Diagnosis.—A pleurisy of the base of one or other of the lungs is often mistaken for peritonitis, as the sharp stabbing pain is apt to be referred to the abdomen where the intercostal nerves terminate. In such cases, especially if the pleurisy involves the diaphragm, the similarity to peritonitis may be great, and it is common to find that hot fomentations or mustard poultices have been placed upon the abdomen by the friends under the idea that there is peritonitis. Where pleurisy exists there is normal tenderness of the abdomen on pressure, and the physical signs of pleurisy or pleuro-pneumonia will be detected in the chest. An attack of colic is not often likely to be mistaken for peritonitis; in the former there is pain and distension of the abdomen, but no tenderness or elevated temperature. An intussusception may be mistaken for peritonitis; but the attack of pain is more sudden in the former, and there is not often much tenderness; the detection of an elongated tumor would usually decide the diagnosis. Acute peritonitis is apt to be mistaken for acute obstruction of the bowels, such as results from the constriction of a knuckle of

bowel by a hand. The distension of the intestines with flatus, the vomiting of sour-smelling intestinal contents, as well as complete obstruction to the passage of stool, may be present in both; there may be little tenderness, and but slight or no fever. The diagnosis may be very difficult or impossible, though the history of the case, the absence of faecal vomiting, and the less complete obstruction to the passage of both flatus and faeces in the case of perityphlitis, will usually help the decision. It is hardly necessary to add that it is only in some cases of acute perityphlitis that the difficulty exists, as usually the pain, tenderness, and distension of the intestines are diagnostic of peritonitis.

Marked Anatomy.—The tendency to pus formation, which all inflammations in children exhibit, is noticeable in peritonitis, as in some cases the fluid found in the peritoneum is thick and turbid, or it may make no pure pus. The amount of lymph and fluid varies in different cases; pus or turbid serum will often be found in meshes of lymph between the coils of intestines, a larger collection being present in the pelvis. In all cases of apparent idiopathic peritonitis, a careful search should be made for a local starting point: the caecum, mesenteric, and retro-peritoneal glands being carefully examined.

Prognosis.—This is always grave: the more acute the symptoms, the more rapidly the fatal result occurs. The prognosis in any case mostly depends on the diagnosis, for, if acute general peritonitis is present, a fatal result is almost certain.

Perityphlitis. Appendicular Peritonitis.—Instead of a general peritonitis taking place, a local inflammatory action may be set up, which results in simple inflammatory induration going on in many cases to the formation of an abscess, or a general peritonitis may supervene. The commonest local peritonitis is a typhloperitonitis or perityphlitis as it is generally called. The caecum is especially apt to be the seat of irritation, a peculiarity which it doubtless owes to its being a waste-ut, in which foreign bodies or impured feces are apt to lodge, and give rise to various forms of trouble. Pigs, fish bones, cherry stones, are apt to lodge in the caecum, and gravitate into the caecal appendix, and though the latter is not normally traversed by the intestinal contents as they pass downwards, contractions are likely to form from the deposition of fecal particles, impassated mucus, phosphates of lime, and other salts. As a result, ulceration of the caecum or appendix is very apt to take place, and a perforation to be followed by a local or general peritonitis. In the majority of cases it is now well recognised that in most cases the mischief begins in an inflammation of the appendix due either to retained secretion or to the presence of some solid matter which may be formed in the appendix, or enter it from the bowel; occasionally there is tubercular disease of the follicles of the appendix, but this would give rise to more chronic symptoms. The symptoms presented by perityphlitis in the child resemble those present in the adult. The attack may begin with diarrhoea and perhaps vomiting, with more or less obscure pain and tenderness in the abdomen, and feverishness. It is often extremely difficult to localise the pain and tenderness in a small child, and it may be quite impossible at first to refer the tenderness to any one spot, especially as the abdominal muscles are apt to be rigidly contracted, and the child cries directly it is touched. The state of the bowels varies, sometimes being relaxed, at other times obstinately constipated. In the course of a few days, during

while time the pyrexia continues, if a satisfactory examination can be made, more or less resistance may be detected by palpation in the iliac or lumbar region, and a dullness on gentle percussion, though this may be masked by the distension of the small intestines. The patient may *rise*, especially if he has been judiciously treated, gradually improve, and all pain and tenderness disappear in the course of a week or two. On the other hand, the tenderness may increase, a distinct hardness and induration may be felt in the right iliac region, the right leg is drawn up, and the child cries with pain if it is moved. The subsequent course of the attack is uncertain: there may be a gradual subsidence of all the symptoms, or if the abscess is unopened, the hectic fever may continue, the child gradually emaciate, while the pus which has been formed is making its way to the surface, and the abscess may point in the iliac region, may discharge into the bowel, or, in rare cases, into the bladder or vagina. Fæces may be found in the pus discharging from the iliac abscess, and a fecal fistula result, or all the signs of general peritonitis, abdominal distension, extreme tenderness, and collapse, may arise etc.

The diagnosis of perityphlitis is often by no means easy, and yet is much important, inasmuch as a mistake in diagnosis may readily cost a life. In the early stages, the disease is apt likely to be confounded with it, especially in small children are coprostasis or accumulation of hardened feces in the cæcum, and invagination of the intestines; in a later stage, when the patient is seen for the first time after an abscess has formed, there may be uncertainty as to the source of the pus. Children who have just begun to run alone, and are able to make frequent excursions into the kitchen, or who are fed on all sorts of indigestible food, are especially liable to suffer from an accumulation of hardened feces in the cæcum, which may set up more or less irritation, and give rise to symptoms exceedingly like those of a perityphlitis. There is distension of the abdomen, colicky pains, vomiting, slight feverishness, constipation, or, on the other hand, diarrhoea; and it must be borne in mind that looseness of the bowels is quite compatible with a loaded cæcum or large intestine. It may be possible to detect a focal tumour in the right lumbar region. The diagnosis in a fretful, spoiled child may be exceedingly difficult, but the symptoms of impacted feces in the cæcum will be rather those of colic, the pain coming on spasmodically, with no pain or tenderness at the intervals; while in perityphlitis the pain will be constant, and the tenderness on deep pressure unmistakable. In any given case it is far better to err on the safe side, and to mistake colic for typhlo-peritonitis, than to fall into the far more serious error of doing a child suffering from a local peritonitis with purgatives and emetics. An invagination with its symptoms of sudden obstruction of the bowel is probably not very likely to be mistaken for perityphlitis; the sudden attack in an infant in perfect health, the colicky pains, the straining, and passage of blood and mucus, and the presence of a painless tumour, would in most cases prevent a mistaken diagnosis. To make a diagnosis, an examination under chloroform may be necessary with the finger in the rectum.

Peritoneal Abscess. Intestinal Fistula.—Apart from the abscession which is liable to take place as the result of a typhlo-peritonitis, other abscesses are liable to occur in the abdomen, due in the majority of cases to

glandular inflammation and originating in the mesenteric, retro-peritoneal, or rectal glands. Local abscesses may also occur as the result of a blow or following a perforation of the intestine in typhoid fever or tubercular ulceration. As an instance of a glandular abscess in the abdomen the following case may be taken as an example:

Abdominal Abscess: Discharge of Pus at Umbilicus.—A girl of seven years of age was admitted to hospital, having suffered for three days with pain in the abdomen, fever, and vomiting. On admission there was some distension below the umbilicus and great tenderness; the temperature varied from 100° to 102°. The day after the umbilicus became prominent and the skin red; it gave way and pure pus was discharged. The wound continued to discharge for some time—on one occasion a finger was inserted down the sinus, followed by a fresh discharge of pus; the finger finally closed on the twenty-eighth day. At the end of two weeks the girl was fit and strong. There was some induration, but no pain or tenderness below the umbilicus. On one occasion there was some pus in a stool.

In another case, that of an infant, seen with Dr. Noble, of Kendal, it was noticed a week or two after birth that the abdomen was more rounded and distended than usual. When five weeks old the abdomen was intensely distended, shiny, with enlarged veins on the surface, and with redness and protrusion of the umbilicus; the abdomen was resistant all over, and nothing could be felt on palpation. A few days later the skin at the umbilicus gave way, and pus discharged freely. The infant a few days after died in convulsions. A large abscess cavity was found at the autopsy, and caecum, mesenteric glands.

In several cases which have come under our notice, with somewhat similar but more chronic symptoms, there has been evidence that an abscess had formed, probably in a mesenteric gland, and had opened into the bowel, pus being discharged with diarrhoeal stools. Other cases occur which are by no means so satisfactory in their terminations as the above, being in many instances associated with a chronic tubercular peritonitis or mesenteric disease. There are symptoms of abdominal trouble, attacks of vomiting and diarrhoea, hectic fever and wasting, an induration and at length an inflammatory blush around the umbilicus; the latter becomes perforated and pus discharges. Frequently, sooner or later, the discharge becomes focal from the presence of intestinal contents, a fistulous opening having become established. In the majority of such cases the abscess apparently originates in a mesenteric gland, an abscess cavity is formed which is surrounded by coils of small intestine matted together, and the abscess opens both at the umbilicus and into the bowel in some part of its course; but as such cases are mostly chronic, opportunities for *post-mortem* examinations are not frequent, and when an opportunity presents itself there is so much swelling of parts that it is difficult to make out the origin of the abscess.

The following case illustrates this difficulty:

Abdominal Abscess: Focal Discharge.—A girl of four years of age was in hospital, from 1895, with chronic abdominal symptoms: fever, and wasting. In the following December she was admitted with a sinus at the umbilicus, discharging pus and intestinal contents, an abscess having broken through the rectum. The fistulous opening continued to discharge pus and liquid yellow granular faeces till her death in October 1896. At the *post-mortem* the liver and spleen were healthy. The umbilical sinus was connected with an abscess cavity containing one or two ounces of pus and faeces, and surrounded on all sides by

muscles matted together; this cavity communicated with the ileum a foot and a half above the anus by two openings large enough to admit a little finger. On the posterior surface of the small intestine were numerous nodules, apparently the remains of a past tubercular peritonitis. In the ileum were many nodules and ulcerous remains of old ulcers and chronic solitary glands.

In this case the perforation of tubercular ulcers or the suppurative inflammation of the mesenteric glands had been the cause of the abscess and fistulous openings. In several cases coming under notice the fistulous openings have closed up permanently, one after discharging for seven months, and in some others the fistulous opening has closed, but the patient died of general tuberculosis.

Treatment.—As soon as the diagnosis of acute peritonitis is established no time must be lost in administering opium in some form or other, the dose being repeated so that not only is the pain relieved but the child is rendered drowsy. The narcotic may be given by the mouth or by subcutaneous injection. For a child of from one to two years, two or three minims of the tincture may be given and repeated every three hours; for a child of from five to ten years, five or eight drops, its effects being carefully watched. Hot fomentations should be applied to the abdomen; some, however, prefer the application of ice—the former is much more comforting to the patient. If the vomiting is severe, all food by the mouth must be stopped and only small quantities of ice allowed; in many cases the vomiting and consequent distress of the patient is maintained by giving large quantities of fluids, such as milk and beef tea. Small quantities of beef tea and barley may be given by the bowel, but it must be borne in mind that large quantities of any sort are liable to do harm by setting up peristalsis of the bowel. Free stimulation with brandy, champagne, or other, must be resorted to in the last stages. In typhoid and other focal forms of peritonitis, the same treatment must be carried out—all forms of laxatives and emetics must be condemned as likely to aggravate the inflammation; rest in bed, open fomentations, small doses of opium and belladonna by the mouth, the most restricted diet, the food being given in the most digestible form and in small quantities. As long as the slightest pain or tenderness is present, the most complete rest must be maintained and all purgatives and emetics avoided. The formation of an abscess must be carefully watched for, and surgical proceedings taken without delay if there is any indication of suppuration.

Since acute purulent peritonitis is practically certainly fatal if it becomes generalised, it is of the utmost importance to provide an outlet for a localised abscess rather than allow it to go on and rupture into the general peritoneal cavity. Hence, as soon as it is clear that a local form of inflammation is not subsiding under medical treatment, the safest course is to carefully cut down upon and let out the matter. In perityphlitic abscess (*appendicular peritonitis*), when with fever there is local pain, tenderness and induration and drawing up of the leg, an incision should be made just internal to the anterior superior spine of the ilium and the successive muscular layers divided until the neighbourhood of the abscess is made clear either by the sense of fluctuation or by the odourous condition of the tissues—a director is then thrust in the direction of the suspected cavity, and if pus appears the opening is enlarged with dressing forceps and the cavity drained and treated on ordinary principles (anæsthetics being used unless the patient is dead). There is

little danger in such an operation; even if an abscess is met with and the peritoneal cavity is opened, no ill result is likely to follow, while the danger of rupture of an abscess into the general peritoneal cavity is very great. Local peritoneal abscess elsewhere is much more uncommon, though it may be met with on the left side (perisigmoid abscess), and this can be made out at times by rectal examination. The treatment is that of the perityphlitic condition. It is of little importance in such cases to make out whether the abscess is really a local peritonitis or a collection of matter in the cellular space outside the peritoneum, since, if peritoneal, it is usually completely shut off by adhesions from the general cavity, and there is no fear of pus flowing from the wound into the peritoneum. Local abscesses elsewhere must be treated on similar principles. Should a general purulent peritonitis already exist, the question of treatment is more uncertain and the prospect far less hopeful; there is, however, little doubt that the right course is to open the abdomen, wash it out with some antiseptic antiseptic, such as boric lotion, and drain the peritoneum. Should there be general fecal extravasation from perforation of the cecal appendix, or from a typhoid ulcer, the case must be looked upon as well-nigh desperate; the attempt, however, may be made to expose the perforation, suture the intestine, and in the case of the appendix remove it and close the wall. Cases of iliac abscess are common, and operation is almost always successful, and though it may be said that these are a different class altogether from the local peritonitis group, it is difficult to distinguish between the two, and there is certainly a risk of perforation into the peritoneum. In appendicular abscess nothing more should be done than simple incision and drainage; no attempt should be made to remove the appendix or look for a cause of the suppuration except that the finger may be gently passed into the abscess and any foreign body removed. We have several times found a focal coconotus lying loose in one of these cavities. The greatest care must be taken not to break down the wall of adhesion round the abscess. The opening of a local appendicular abscess is in our experience almost, if not quite, always a successful operation, but it is of course no otherwise if the suppuration has been from the first, or has been allowed to become general; in such a case, too, a full search must be made for the source of the trouble, and an attempt made to remove it, whether by ligature and excision of a perforated appendix, or such other means as the particular case may require. (*vide also* pp. 123 and 124.)

In cases of recurrent appendicular peritonitis removal of the appendix is undoubtedly the proper course to pursue, since life is in constant danger as long as the source of the mischief remains.

Chronic Peritonitis.—Chronic peritonitis is a comparatively common affection during childhood, and in the vast majority of cases is tubercular. A few cases of chronic non-tubercular peritonitis in which the diagnosis has been confirmed by a *post-mortem* have been recorded, notably one by Hensch which ran a course of six weeks; at the *post-mortem* cloudy fluid and organising lymph were found in the peritoneal cavity. This case seems to have originated in a blow. Cases also not infrequently occur in practice of chronic peritonitis with ascites, in which there is no evidence of tubercle in any organ, and which completely recover; this, however, is no bar to the acceptance of the belief that such are tubercular, as there is ample *post-mortem* evidence

to show that tubercles and lymph on the surface of the peritoneum may become cretaceous or be converted into fibrous tissue. Two forms of chronic tubercular peritonitis are met with in practice, in which for the most part a well-marked clinical difference exists, one distinguished by the large amount of ascitic fluid and in which probably ascites is the only symptom present, and the chronic coexisting form in which there is induration and thickening of the great omentum and a matted together of all the abdominal organs with little or perhaps no fluid. The same tubercular process is going on in both cases, but produces in one a large amount of effusion, in the other less or perhaps no fluid, but the effusion of lymph and its gradual organisation and contraction.

Acute Form.—Chronic peritonitis is by far the most common cause of ascites, or rather dropsy commencing in the peritoneal cavity during childhood, while, as well known, some form of portal obstruction is the constant cause in adults. Ascites due to chronic peritonitis is not common during the first year of life; not that it does not occur, but the infant dies before the chronic stage is reached. It is not uncommon during the second year of life, and occurs with some frequency up to and beyond puberty. There is generally a history of pain in the abdomen of a more or less obscure kind which has been regarded as due to indigestion, probably also both diarrhoea and constipation, and then the belly begins to swell. In some cases the enlargement of the abdomen is the first symptom which leads the friends to think anything is wrong with the child. On examination a rounded and distended abdomen is found, there is fullness and fluctuation to be felt in the flanks if the patient is lying on his back; while there is a more or less extended region of resistance around the umbilicus where the distended small intestines are balled up to the surface. The fluid may, however, be localised by adhesions. The abdomen is often greatly distended, the skin tense and shining, the abdominal veins enlarged and tortuous, and in young children the skin at the umbilicus is protruded, and contains fluid which can be pressed back into the abdomen. There is usually complete absence of pain and tenderness, the disease is frequently feverless during the greater part of its course, and the patient looks rather as if he were suffering from ascites due to some obstruction in the portal system. The course of the disease is essentially chronic, and recovery by no means hopeless, as there are not a few recorded instances of complete and permanent improvement taking place.

Thus in one case a girl, aged 15 years, who was in hospital for some five months, and from whom eight or nine pints of ascitic fluid were removed through one of Southey's canulas, completely recovered, and was four years after a strong girl, supporting her mother and family by her work. In several similar cases we have seen recovery take place; one suffered from a tubercular focus which discharged through the scrotum and healed. On the other hand, such children are apt to be carried off by a tubercular meningitis, or the mesenteric glands become cheesy, or a tuberculous of the lung takes place. In any case it will, of course, be necessary to carefully examine the lungs, and a long-continued hectic and wasting would suggest a more extended area of tuberculous. In cases which end in recovery there is probably a matted together of the intestines, and frequently more or less induration may be felt about the great omentum or caecum. In cases which

any of long standing it occasionally happens that a perihepatitis with more or less induration of the liver takes place. This was the case in a boy of 11 years who was admitted to hospital under the care of Dr. Hutton, with ascites, oedema of the feet and ankles, jaundice and enlarged liver; at the *post-mortem* the liver weighed 15 oz., the capsule was thickened and the surface was irregular and granular: in section there was a great excess of fibrous tissue, and old and recent peritonitis and tuberculosis of the lungs.

Chronic Form.—In many cases of tubercular peritonitis there is little or no ascites from first to last, but lymph is effused on the surface of the peritoneal covering of various organs, and if the patient live long enough, fibrous adhesions are formed. On the *post-mortem* table, local or general peritonitis is frequently found in children dying of tuberculosis; thus, out of 105 *post-mortems* of tubercular children made during the four years 1882-85, there was peritonitis in 38, though in a comparatively few of these was the peritonitis an early and important lesion. While this form of peritonitis is mostly chronic, yet some cases run a more active or subacute course. The early symptoms are pain in the abdomen, mostly referred to the umbilicus, often attacks of sickness and diarrhoea, hectic, and the presence of induration or irregular-shaped tumours felt through the abdominal walls. The amount of tenderness on pressure differs greatly, being most marked in the acute cases, and being absent in the chronic ones. But in cases wasted and exhausted by acute disease, even a purulent peritonitis may be present without any pain or tenderness. The state of the abdomen varies, it being sometimes distended with wind, at other times more or less retracted; often no distinct tumour can be felt, but on very gentle percussion a distinct loss of resonance, or a muffled resonance, may be detected over the umbilical region in consequence of the thickening and induration of the great omentum, or a resistance may be felt on palpation, or hard irregular tumours can be detected, the result of matting together of the omentum or intestines. Hectic fever is mostly present, the temperature rising to 102° or 103° at night and falling to normal in the morning, and more or less general wasting of the body ensues; but the amount of fever and wasting present will depend upon the extent to which the mesenteric glands and thoracic viscera are affected. Diarrhoea is not usually a marked symptom unless tubercular ulceration has taken place. The subsequent course of these cases differs much; in the minority, after several months of hectic, improvement slowly sets in and the patient improves, for a time at least appearing fairly well. In the majority the fever continues, the wasting becomes more apparent, diarrhoea, and perhaps cough, comes on and the child sinks. In others, the lungs remain free to the end, but mesenteric disease ensues, ulceration of the bowels takes place, perhaps local abdominal abscesses form, and the liver, spleen, and kidneys become indurated. In only four of the thirty-eight cases of fatal tubercular peritonitis mentioned were the lungs and mediastinal glands found entirely free from tubercle.

Prognosis.—The course of chronic tubercular peritonitis is usually long, unless some intercurrent disease, as tubercular meningitis, supervenes. Children may be under observation for many months, with either ascites or induration of the omentum, with more or less hectic, and with no evidence of any active disease of the lungs, and finally to all appearance completely recover. On the other hand, the onset of diarrhoea, hectic, progressive

emaciation, and cough, with evidence of lung mischief, points to the existence of more or less generalised tubercularis, which necessarily shortens the duration of the illness. Albuminuria, as pointing to lactaceous disease, would be of bad omen.

Diagnosis.—When a child is presented with an ascites which has made its appearance gradually, without pain or fever, it is perhaps not unnatural to attribute the collection of fluid in the abdomen to obstructed portal circulation. In an adult the commonest cause of ascites is cirrhosis of the liver, in a child by far the most frequent cause is chronic tubercular peritonitis. In a given case it may be quite impossible to make a certain diagnosis, inasmuch as for a while the ascites may be the only symptom present; there may be a complete absence of pain or tenderness, the most careful palpation may fail to detect any induration of the viscera. The bowels may distend up and cause a resonant note on percussion at the umbilicus when the patient is on his back, the resonance shifting to the flank which is uppermost when he lies on his side. It may be impossible to feel the edge of the liver, or may it out by percussion. In other cases, however, there will be less difficulty, for there may be hectic fever, or diarrhoea, or abdominal pain and tenderness, or after paracentesis lumps or masses of induration may be felt. A family history of tuberculosis would naturally favour the view of tubercular peritonitis; and occasionally the presence of a cheesy deposit in a testis will decide the diagnosis. The fact that the fluid is encysted is in favour of tuberculosis.

Medical Anatomy.—Fluid varying in quantity will be found in a few cases; it may be clear or cloudy serum or pus, in which latter case it is usually localised; it is too viscous, or separating the intestines, to find small local collections of pus. Tubercles and lymph are usually present on the great omentum and mesentery, matting the intestines together, also between the liver and diaphragm and around the spleen; where there is no large collection of fluid, the adhesions are frequently very extensive; the intestines and stomach may be adherent to the abdominal wall, so that on opening the abdomen the intestines are frequently cut into. The intestines, mesentery, great omentum, liver and spleen may be so matted together, partly by lymph, partly by fibrous adhesions, that it may be impossible to separate them. The intestines may be so adherent and bound down as to form bends and kinks that it is impossible to unravel. Cheesy mesenteric glands and tubercular ulcers will very likely be present.

Treatment.—Any pain and tenderness in the abdomen in a child with tubercular tendencies should excite apprehension and never be neglected. Rest in bed should be enjoined, and a diet consisting of beef tea and milk should be given. The pain may be relieved by applications of belladonna, and glycerine covered with cotton wool, or by fomentations. The bowels should be relieved by enemata and laxatives rather than purgatives. In the chronic stages, when the abdomen contains fluid or there is evidence of thickened and indurated omentum or cheesy masses, mercurial applications may be used. An ointment of yellow oxide of mercury (20 grains to the oz.), with an equal quantity of ung. belladonna, may be used, with cotton wool to cover it. Lin. hydrag. may be used, but salivation is likely to follow if continued for too long a time. Tonics and cod-liver oil emulsion

should be given. Chronic purulent peritonitis, whether tubercular or not, should be treated by incision and drainage, if the child's health is failing; and there is good evidence to show that not only may temporary relief be thus given, but long lasting, if not permanent, recovery may take place as the result of incision. Even where the fluid is not purulent in obstinate cases drainage is of service; it appears to cause adhesion and thus to prevent the re-collection of fluid, while at the same time organisation takes place. We have little doubt that, in all cases of tubercular peritonitis in which there is any considerable collection of fluid, whether purulent or not, the abdomen should be opened and drained as soon as it is evident that in spite of treatment extending over some months no improvement is taking place. We have successfully employed this method, and are impressed with its value.

Iliac Abscess.—The occurrence of iliac abscess, right or left, is frequent in children, and the various causes of such mischief should be borne in mind; the principal ones, some of which have been already mentioned, are caries of the spine, tubercular disease of the mesenteric glands—in this case the abscess is more often umbilical—disease of the hip, traumatic lesions, or sacro-iliac joint, pyelophritic abscess, rare in children, and the well known cases of hydatid cysts. Empyemata, superficial abscesses and abscesses the result of injury, 'simple proctitis' &c. are to be thought of in addition to those already described as resulting from irritation of the caecum or appendix. But besides all these, it is common to find iliac abscesses the cause of which remains obscure, and we are satisfied that in many of these cases the suppuration is simply due to inflammation of lumbar, iliac, or pelvic lymphatic glands, just as cervical abscesses occur from irritation of the glands of the neck. The source of irritation is often doubtful, but is sometimes due to the presence of worms or other irritating matters in the bowels; sometimes to extension from the more superficial lymph glands. The diagnosis can usually be made by careful exclusion and by the history; rectal examination is often of much value, by enabling the extent and position of the abscess to be made out, as well as sometimes by revealing a source of irritation. These abscesses should be opened antiseptically and drained in the usual way—it will often be found that they extend for long distances upwards or downwards into the pelvis. The limb on the affected side should be stretched by a splint or by extension. The prognosis is good, provided no permanent source of suppuration be present. Almost every case that we have seen has recovered, and we believe this is largely due to early opening of the abscesses.¹

Acute Obstruction of the Bowels.—Children occasionally suffer from acute obstruction caused by twists in the bowel, constricting bands, impaction of foreign bodies, and internal hernia; by far the most frequent cause is, however, an intussusception.

Intussusception

The commonest cause of obstruction of the bowels in infants is the presence of an invagination of the bowel. Many reasons have been given for

¹ For detailed cases of this nature we may refer to a paper in the *Arch. of Pediatrics*, vol. i. 1884, and to the *Children's Hospital Reports*—also *Lancet*, February 1894.

this somewhat frequent accident. There is no doubt that one cause is to be found in the great reflex irritability of the muscular coat of the infant's bowel; vigorous peristalsis is easily set up, and, moreover, the intestinal walls being thinner during infancy than in later life, an invagination of one portion of the gut into a lower portion more readily takes place. This is seen in the *post-mortem* invaginations so often found: the act of dying seems to stimulate the peristalsis of the bowels, and it is no uncommon thing to find on the *post-mortem* table many invaginations in the ileum an inch or two in length. In some cases an accident, such as falling out of bed, or some rapid movement up and down in the parent's or nurse's arms, has produced symptoms of an intussusception, and it is possible that a sudden movement might cause a toneless piece of gut to become invaginated. It must also not be forgotten that the infant's intestines, especially the cecum and colon, are more movable than those of an adult, having a wider mesentery, and consequently one piece of bowel is more easily dragged into another portion.

The exciting cause of intussusception is occasionally found to be a polypus, or an inflammatory thickening of the cecum, or some hardened nodule of fecal matter which adheres to the wall of the gut and sets up local peristalsis. We have met with a case related below in which possibly a local peritonitis causing thickening of the bowel was the immediate cause of the invagination.

With regard to the frequency of intussusceptions at different ages, it has been stated by Pitt that, out of 203 cases, 153 were in their first year, and of these 98 were from 4 to 6 months of age. According to Leichnerstein, out of 122 cases, 75 were under a year old, and 47 from one to five years of age. It is certainly the common experience that the majority of cases occur in infants under a year, and that from 4 to 6 months of age is a very common time.

In at least three-fourths of the cases in infants the invagination is ileo-caecal, in the minority of cases it is ileum into ileum or colon into colon.



Fig. 11.—Ileo-caecal intussusception. a, ileum (the intussusceptum); b, int. edge of intussusception; c, edge of intussusception; d, colon (the intussusceptum).

In the ileo-caecal variety the ileum enters the cecum, not through the ileo-caecal valve, but the caecal valves are pushed before it, so that the valves themselves occupy the lowest part, and as it moves downwards, more and more of the ileum enters, dragging its mesentery along with it and forming the inner tube, while the middle layer is formed by the inverted cecum and colon, the colon also forming the outer layer. The layers of an intussusception therefore consist of (1) an outer layer of intestine into which the invagination takes place, the peritoneal coat being external and the mucous membrane internal; (2) a middle layer continuous with the outer layer at its upper end, but turned inside out so that the mucous membrane is external and the peritoneum internal; (3) an internal layer formed by the intestine entering the outer layer with its mesentery and vessels, and which

becoming nipped as it travels downwards forms the stoppage. In consequence of the mesentery becoming dragged in, the included intestine does not lie in the centre of the containing gut, but is more or less lifted to one side. As a result of the invagination, the inner and middle layers become congested and oedematous and of a dark-red colour; blood is extravasated from the congested mucous membrane and is passed per rectum. In some cases, lymph is thrown out by the serous surfaces and a local or general peritonitis takes place. In a few cases, more particularly in the ileum into ileum variety, sloughing may take place and the invaginated bowel be separated and passed per rectum, while faeces may be extruded or recovery take place by a process of constriction. The extent to which life is threatened depends very largely upon the tightness with which the bowel is nipped and the circulation of blood obstructed, and this appears to vary to a considerable extent, so that death may ensue in a few hours with the symptoms of collapse, or, especially in older children, where the bowel is only partially obstructed and the circulation of blood through it but slightly interfered with, the course may be chronic, going on for weeks or even months.

Symptoms.—An infant of a few months who may very probably have suffered for a few days from symptoms of bowel irritation, suddenly begins to kick and scream as if in violent pain which nothing appears to relieve. It soon begins to vomit continuously, and strain as if it wanted to pass a stool, but nothing escapes but a little blood and mucus. In the intervals between the attacks of vomiting and colic, the infant may be tolerably quiet, but it is usually restless and moaning as if in pain. An examination of the abdomen shows it to be moderately distended and resistant, though in some cases we have noticed it to be flaccid, and on careful palpation in the course of the transverse colon, an inch or so above the umbilicus and towards the left hypochondriac region, an elongated tumour may be felt, which is movable, and, as a rule, not acutely tender. There may be also a feeling of want of resonance in the right lumbar region from the absence of the caecum and ascending colon. In very fat infants it may be impossible to detect such a tumour. We must not, however, forget that if an early examination be made no tumour may be felt, inasmuch as the invaginated portion of ileum may only have passed two or three inches into the caecum and lie too deeply to be felt. If it travels as far as the splenic flexure of the colon, it is tolerably certain to be felt. In some cases, as in one related below, no tumour was felt after forty-eight hours. The rectum should be next carefully explored with the finger, and the presence of a tumour there, which is pressed down when the child strains, while the withdrawn finger is covered with blood, would establish the diagnosis. The position of the tumour necessarily varies according to the length of the included gut; but inasmuch as the colon is nearest the abdominal wall where it crosses the upper part of the umbilical region, if this part is involved, as it usually is, the tumour will be most readily felt here. The temperature is mostly normal or subnormal, unless there is peritonitis, when it may be raised a degree or two. The tumour is usually not acutely tender, but if the case be an acute one, or, in other words, if the included gut be tightly jammed and its vessels strangulated, the child may scream on its being pressed. If the case continues unrelieved, the vomiting,

straining, and distress continue, the child wears an anxious, pinched expression, with sunken eyes, and dies with the symptoms of collapse. The period at which death takes place varies; in infants it may be within twenty-four hours, more often from the third to the fifth day.

While the above description applies to the majority of cases, it must be borne in mind that the symptoms are at times far less well marked, so that the presence of an intussusception may be overlooked; there may be perhaps vomiting, colicky pains, and mucous stools, the infant dying in convulsions. On the other hand, it is possible that an invagination may occur, and fortunately right itself before it becomes tightly impacted.

In older children, when the ileo-ileo-cæcal variety occurs, the obstruction is mostly complete and the symptoms are those of strangulated hernia, or constriction of a knuckle of bowel by a fibrous band. The onset is sudden, the contents of the stomach being first vomited, then the intestinal contents, and finally, the vomit has a distinctly fecal odour; neither wind nor feces are passed per rectum, but in some instances small quantities of mucus and blood. The abdominal pain is usually of an intermittent and colicky character: the abdomen is rounded but not tender, at least in the early stages. In this case a tumour is not likely to be felt through the abdominal wall, inasmuch as the lower end of the ileum, which is usually involved, lies deep and is probably covered by distended intestine; though in one case reported by Herlika, where the tumour was supposed to be due to an ileo-cæcal invagination, a swelling was felt in the region of the navel which was three inches long, movable and tender; the child recovered. In these cases no rectal tumour is present.

When an ileo-cæcal intussusception occurs in older children, the course is usually more chronic, and the symptoms less acute. There are attacks of colic and vomiting with obstruction of the bowels, though the latter is not always complete, as there may be slimy mucus passed with or without blood. An elongated tumour is usually felt in the usual position, lying across the abdomen immediately above the umbilicus. If strangulation does not occur, the case may go on for weeks or months. The cause of the obstruction is with cases is apt to be overlooked, as the obstruction to the passage of feces is not complete, and the symptoms not acute, and the tumour felt closely resembles distension of the large bowel with hard feces.

Morbid Anatomy.—On making a *post-mortem* examination, care must be taken to distinguish between an intussusception which has taken place during life and given rise to the symptoms noted, and an intussusception which is *post-mortem* and caused by the irregular yet vigorous peristalsis of the bowels which may take place during the act of dying or after death. In the latter case the invagination involves the ileum, or at any rate the small gut, and there are often several of them. They are rarely more than an inch or two in length, are readily pulled out by gentle traction, and while a ring of congestion may be seen near the seat of constriction, or where the gut has been doubled on itself, there is no oedema or marked congestion or effused lymph. A *post-mortem* invagination does not completely occlude the passage of the gut. In the examination in a case of the ileo-cæcal variety which has become strangulated, an elongated mass, dark red in colour, is seen lying in the course of the transverse colon continuous with the

at its lower end, while the ileum with its mesentery is seen to enter at its upper end; the ascending colon and cecum will have disappeared. In most cases the contained gut cannot be withdrawn without tearing, as it has become rotten from gangrene. Its passage will, in an acute case, be completely occluded, partly on account of the ulcerations and congested inner layers, partly by reason of the tilting on one side of the inner gut through the dragging in of its mesentery. Lymph may be found effused between the two peritoneal surfaces, gluing them together, and there may be evidence of a more general peritonitis.

In chronic cases less congestion is seen, the bowel probably is not entirely obstructed, and the bowel above is generally hypertrophied and its mucous membrane is a condition of ulceration.

Diagnosis.—The diagnosis in an acute case in an infant is not likely to give rise to difficulty, inasmuch as the sudden attack of vomiting, with pain, straining, and the passage of blood and mucus from the bowel, and the discovery of an elongated tumour through the abdominal wall or per rectum, make the case tolerably clear. We may be more in doubt if with the above symptoms no tumour can be felt; but we must bear in mind that a short ileo-cæcal invagination may be present and lie too deeply in the right iliac region to be felt. But the question of the presence of an intussusception sometimes arises in infants who are suffering from symptoms of obstruction in the bowels of an uncertain origin, possibly with a certain amount of thickening or resistance in the right iliac fossa, which may be due to the impaction of faeces in the caecum or to an invagination. In all such cases, as long as any doubt exists, purgatives should be avoided, and small doses of opium given to allay the pain and straining. If there is pain on deep pressure, it is better to avoid enemata, trusting rather to narcotics. In older children the error may be made of mistaking an ileo-cæcal for an invagination of the bowel and *volvulus* (see *Ileo-cæcal*), or obstruction of the bowels from other causes may be taken for intussusception. (*Life cases*, p. 124.)

Treatment.—The treatment which is to be adopted must necessarily vary according to the acuteness of the case and the time the symptoms have lasted, for if the bowel has passed into a gangrenous condition it is obvious that only harm can be done by mechanical treatment, which might have been of the greatest service in an earlier stage. The question to ask oneself before commencing treatment is, what is the state of the invagination? is the gut tightly jammed? is it gangrenous? Unfortunately these questions are very difficult to answer, inasmuch as in some cases the inner layer of bowel becomes tightly impacted from the first, and no amount of force applied by distending the bowel per rectum will replace it, while in other cases rotiness has attended inflation of the lower bowel with air several days or even a week after the onset of symptoms. Thus in a child aged 7 months, under the care of Dr. J. S. Bury, injections of oil and afterwards of air were employed fourteen hours from the commencement, but failed to reduce the invagination, the infant dying twelve hours later, within twenty-six hours of the onset; at the *Autopsy* 'reduction was quite impossible without tearing the gut; there was some lymph effused locally.' In this case, by the end of twenty-four hours the bowel was tightly strangulated and neither

the injections into abdominal section could reduction have been effected. Such a case is no doubt exceptional, and it would probably have ended fatally under any circumstances unless mechanical replacement could have been undertaken, or laparotomy performed within a very short time of the seizure. By the time the invaginated portion of the bowel has travelled along the colon as far as the rectum, the collapse produced, especially in a small infant, is very great, and the difficulties in the way of replacement are necessarily much greater than if only a few inches of bowel are involved. But cases appear to differ very much in the amount of oedema and congestion taking place in the ripped bowel, and consequently in the difficulty of replacement. While some cases, such as the one just referred to, are acute and irreducible almost from the first, others are reported in which the intussusception was reducible some days after the onset of symptoms; in one case, reported by Dr. W. B. Cheal,¹ in a boy aged 3½ years, the invagination was successfully reduced by massage and the injection of an enema the seventh day from the onset. In another case, reported by F. H. Elliott,² in an infant of 3 months, attempts at intervals to reduce the invagination were at first only partially successful, but finally succeeded.

As soon, then, as the existence of acute intussusception has been ascertained, it becomes necessary to decide without delay whether the patient shall be left to nature, or whether mechanical means shall be employed to overcome a mechanical obstruction.

Recoveries after spontaneous reduction and after sloughing have been recorded, but they are so rare that waiting for a natural cure means practically abandoning the child to almost certain death. Even if recovery by sloughing takes place, the risk of subsequent stricture has to be considered. It is then clear that some attempt at reduction should be made, and we have the following plans at our disposal for this purpose:—(1) Inversion of the child, combined with external taxis or aspiration. The child is held up by the legs with the head downwards, and an attempt made to draw the contents of the abdomen to the upper part of the abdominal cavity by breathing and stroking with the hands through the abdominal wall, or by sudden shaking movements of the child; an attempt is made to dislodge the intussusception. It is clear that this plan can only be expected to succeed when the intussusception is small in extent and recent in formation; it is in such cases worth a trial since it is attended with danger. Chloroform should be given during the manipulations.

(2) Distension of the bowel with fluid or air in the hope of pushing back the invagination.³ If fluid injections are employed an enema tube fitted with an anal shield should be passed into the rectum, and warm water or oil allowed to flow into the bowel from a vessel raised above the level of the patient's body. The amount thus injected must vary with the age of the child and the position of the intussusception; from one to two pints is about the usual quantity, and a fall of from three to six feet is required.

Inflation by air is best managed by passing the nozzle of an ordinary pair

¹ *Lancet*, Oct. 25, 1885.

² *Ibid.* *ibid.*, p. 1878.

³ *Prof. Mortimer, Lancet*, May 25, 1901, p. 1144, for an account of experiments upon the intussus.

of bellows, fixed with the pipe, into the rectum, and blowing air in till the tumour is felt to give way, or it is not safe to distend any further. In both these methods the abdomen should be carefully watched, and a hand kept on the intussusception tumour to feel for any change in its size or position.

The following cases illustrate the success of these methods of treatment.

Intussusception; Injection of Air; Recovery.—A fine healthy infant, 6 months old, was suddenly seized, on the evening of January 2, with growing pains and vomiting. It had been brought up on the breast, with a bottle or two a day of cow's milk. Thereafter was constipated for the first time, and the infant was cutting two lower teeth. Its mother gave him an enema with a small bell syringe, which brought away a large curdy stool. During the night he was very restless, vomiting frequently, and stirring constantly, and at 7 A.M. passed a bloody stool with mucus sufficient to saturate an ordinary napkin. We saw him with Dr. F. R. Smith, of Kewford, next morning, January 3, three hours after the seizure. His face was pale, but there is statement: there was no fever; the abdomen was flaccid and not distended, and could be easily palpated in every part. On deep pressure an elongated tumour was felt: the left end was most distinct, and was situated in the left lumbar region, just below the ribs and near the tip of the spleen; it could be moved from left to right across the abdomen for two or three inches, its surface being gradually lost. It was movable and not tender. No tumour could be felt in the right lumbar region or per rectum; but the finger, introduced without, was covered with blood. We at once decided to reduce the intussusception, which we believed to exist, by distending the colon by water pressure. The strangest results followed, as the water strained by the side of the catheter in the rectum without distending the colon to any great extent. We next tried the inflation of air, by means of an ordinary Higginson's syringe, the bore needle being inserted into the rectum: the pains were raised, and the tumour greatly kneaded, while air was forced into the bowel by squeezing the bulb of the syringe. After four or five repetitions the tumour in the colon was felt to be considerable, then followed a purging stool, and the tumour disappeared. We continued to pump now and then, in the hope that we might effect the complete reduction of the intussusception. The infant seemed relieved, and went to sleep for some hours, but towards evening the vomiting returned, and he spent a restless night. There was no recovery; he passed per rectum some later, blood-stained mucus and a little stool. We saw him again next day, January 4. There was some distant reticulation now on his face; he had rotatory pains at times; there was no tumour to be felt. A minute of tr. opii was given, and the infant was placed in a warm bath for ten minutes. The colon was slowly distended with water again by means of a Higginson's syringe, the infant lying in an inverted position; an immediate effect appeared to be produced. Three hours later another minute of tr. opii was given. An hour later, after another warm bath, he passed a copious yellow liquid stool. From this time he continued to improve, though for a few days he was gripped at times and passed small quantities of blood and mucus in his stools. Small doses of opium were given for a few days.

Intussusception; Injection of Water; Recovery.—A healthy infant of 3 months, who was nursed at the breast for three months, and latterly fed on milk and water, was seized, on the evening of February 7, with vomiting and abdominal pain. He had been constipated for some time previously, with for a day or two, more restless than usual. During the night he passed some blood per rectum. He continued much in the same state during February 8 and 9. We saw him with Dr. Marshall, of Dalbury, on the evening of the 10th. There was no distended tumour on his face, but he was pale and restless than usual. The abdomen was tense-distended and flaccid; no tumour could be felt, though we were able to pass deeply into the abdomen. He matted at dinner; and the finger, introduced into the rectum, returned covered with dark decomposing blood. A minute of tr. opii was given, and he was put into a warm bath; glysterine was given, and warm water injected per rectum by means of a Higginson's syringe. There was much straining and restlessness at first, but this was gradually overcome. It was evident, on percussion, that the water

reached the ascending colon and cecum. Having descended the lower third toward the waist, we continued to work and see the effect. After the last injection he vomited some mucous, greenish fluid. Five hours afterwards he passed a liquid stool and made a good recovery.

These plans are open to the objections, first, that there is distinct danger of over-distension and rupture of the bowel, as shown by the experiments of Bryant and others; secondly, that they can only succeed where no adhesions have formed between the adjacent peritoneal surfaces; and thirdly, that even if reduction does apparently take place it may be incomplete or invagination may recur. A case of our own well illustrates this last fact.

Intussusception; Abdominal Section, Fatal.—Harold T., aged 7 months, was admitted into the Children's Hospital, May 30, 1897, with symptoms of acute intussusception of three days' duration. The invagination could be felt externally in the left iliac region, and internally per rectum. Under abdominal inflation was employed without success; ten ounces of water were then injected through an India-rubber tube three feet long, with the result of causing disappearance of the tumour and removal of resistance previously offered to the right iliac area. He kept quietly for some hours, and then began to vomit again, and the intussusception reappeared. Inversion was again apparently successful, and the child spent a quiet night. The next afternoon the symptoms reappeared, but were more easily relieved by inflation. The next day the general condition was worse, and, as it was clear that no complete reduction had taken place, abdominal section was performed, the intussusception found and reduced; the bowel was inflated but not perforated, there were no adhesions, and the invagination was successful. The child sick and died a few days later.

(3) Abdominal section may be performed and the obstruction relieved by more direct means. The incision is best made in the median line below the umbilicus, the bladder having been previously emptied. As soon as the abdomen is opened, the intussusception should be drawn to the surface and carefully examined. If the bowel is in good condition a careful attempt should be made by gentle traction to withdraw the 'intussusceptum.' Reduction is sometimes best managed by squeezing the tumour and drawing the 'intussusceptum' off the 'intussusception,' rather than by directly pulling out the invaginated gut. If this can be done and the bowel is not too much injured for recovery, it should be left to itself and the wound closed.

Intussusception; Abdominal Section.—In a case about as rare as that by Dr. C. of Boston, our patient, a child of eight weeks old, had symptoms of twelve hours' duration. With the help of Drs. J. J. and F. C. and Hyatt, an attempt was made to reduce the invagination by operation; this partially succeeded, but a failure could still be felt in the right hypochondrium. We then opened the abdomen and drew up the tumour, which consisted of the cecum with the caecum intestine entering it. At this point there had been evidently a previous local inflammation, since the parts were much thickened and inflamed, and the adjacent glands were enlarged. The intussusception had been reduced, and nothing more appeared necessary. The abdomen was closed, and the child got quite well. It, however, unfortunately died of pneumonia three or four weeks later.

If the bowel, however, is too much injured to have a reasonable chance of recovery, or if the intussusception is irreducible, one of three courses must be followed—either the bowel must be opened above the narrow and an artificial anus made, the invagination being left to itself, or the intussusception must be resected and the two ends of the gut stitched together, or

finally, after resection the two ends may be brought out of the wound and fixed to its edges, an artificial anus being made. The plan of leaving the intussusception alone has no advantages, inasmuch as the injured bowel will almost certainly act as an irritant and set up peritonitis. The plan of resection and uniting together the ends of the bowel, if successful, gives, of course, the most perfect result; but it is open to the objection that it is long and tedious, and the child is likely to die of exhaustion, and, further, there is danger of leakage even after the most careful uniting. If this plan is adopted, it is probably wise to use Senn's method of lateral anastomosis, or Barker's plan of resection of the intussusceptum from within the gut, or one of the many other modes of uniting the ends of the bowel may be employed. Of these that by Murphy's button is probably the quickest method; but in the absence of any of the special appliances, simple direct union by Lembert's method may be employed. The least dangerous course is to resect the tumour and fix both ends of the gut to the abdominal wound. Subsequently, i.e. after several weeks, should the child recover, an attempt may be made to restore the natural channel and close the artificial anus by the usual method. The ends of the bowel may either be dissected away from the edges of the wound and united to one another by sutures, or the 'spur' ('*éperon*') between them may be removed by the enucleation and so the aperture closed, or the two ends may be united by Senn's or other method. This, though a less showy plan and one requiring more prolonged treatment, is safer at the time than the other method of immediate union after resection, though in a case where the child appeared well able to bear the more severe operation, immediate union is the proper course, especially if suitable appliances are at hand. The utmost care in all cases must be taken to prevent the escape of the intestinal contents into the peritoneal cavity: this is managed by emptying the segment of gut dealt with before opening it, and keeping it empty by pressure of an assistant's fingers or a clamp, such as a pair of forceps shielded with soft rubber and fixed very lightly on the bowel, so as not to bruise it. All blood &c. must be carefully cleaned out of the peritoneum, and most surgeons will prefer to use aseptic measures.

Given, then, a case of acute intussusception, inversion and injection, should first be gently tried:—should these means be successful as shown by the bowels acting, well and good; if after injection the tumour disappears, it is well to wait for a few hours to see whether the bowels are relieved. If, however, the tumour does not disappear, or if in spite of its disappearance, or of course in its absence from the first, the symptoms persist, immediate laparotomy with reduction of the invagination, if possible, should be performed, and if not reducible the tumour should be resected and dealt with by one of the methods mentioned. For further details, we must refer to the general text-books or to Mr. Treves' work on Intestinal Obstruction.

Chronic intussusception is exceedingly rare in children, except, perhaps, as one form of so-called prolapse of the rectum, which is really intussusception of the upper into the lower part of the bowel. A chronic invagination may, however, occur elsewhere: its duration may be weeks or months; Treves

¹ If injection proves unsuccessful, the child should be kept under the influence of opium, and the penis clamped above the level of the tumour.

records a case of a year's standing and a desolating one of nearly years' duration. We have had a child under the joint care of our colleague Dr. Hutton and ourselves in which a chronic intussusception of the ileo-caecal variety existed for a year, and which ultimately died of focal necrotisation from gangrene found at the time of abdominal section. The whole tumour was soft and pulpy, there was intermittent obstruction, no vomiting, tenesmus, or bleeding, much distension with visible peristalsis, at times, at others a flaccid abdomen; no definite tumour was to be felt in the rectum or abdomen, and, in fact, the symptoms in this case, as in most of those on record, were very uncertain, and not at all characteristic of intussusception. Enterotomy or resection was the only thing that could have relieved this case, and if the symptoms were at all urgent we should recommend it in another case, reduction of the intussusception being quite impossible. The bowel in these cases sometimes doughs away as in the acute form. In the simple rectal form the prolapse is usually reducible, and if so can be cured by rest, avoidance of straining, and, if necessary, the use of the rectum as in other cases. It is of the utmost importance that the motions should be passed in the recumbent position, and should be kept soft by doses of cod-liver oil or by mineral emulsion. 17th RECTAL PROLAPSE.—We have recently (1895) seen with Dr. Cox a child in whom there were symptoms suggestive of intussusception, though there was no bleeding or tenesmus. There was obstruction, with a palpable oval mass lying on the right side of the umbilicus, and closely resembling an intussusception. We, however, came to the conclusion that the case was one of tubercular mesenteric glands, which by pressure or traction caused the obstruction, and on opening the abdomen this view proved correct; the viscera was a large mass of glands cascading and beading down, and other enlarged glands were found. The manipulation relieved the obstruction, but the child was too ill to bear removal of the glands, and died a few days later.

Chronic Obstruction of the Bowels.—Reference has already been made to the constipation of infants and older children, due to an atonic condition of the colon or a chronic irritable catarrh; but other causes of inactive bowels exist which are attended with serious inconvenience, and even fatal results. There is reason to believe that occasionally flukes bands, due to old, perhaps a fatal peritonitis, run together the coils of intestine, more especially the lower part of the ileum, and consequently check or interfere with the peristaltic action of the bowels. It appears also that occasionally the sigmoid meso-colon and meso-rectum are shorter than usual, being the lower bowel, and perhaps more or less forming a kink at its natural curve, where hardened faeces may lodge and a temporary obstruction takes place. A fatal case, which seems to have been due to this cause, is recorded by Dr. Estlin Smith, the patient being a boy of 3 years who died shortly after coming into hospital. Whatever may be the cause, cases not infrequently come under observation where the child has suffered from constipation, all in all, large accumulations of faeces taking place in the colon which have to be re-

* For further information Mr. Richardson's paper in the *Medical Rec.* June, 1874 may be referred to, also Hunt, *Ann. of Widespread*. D. S. H. 9 and see the later records in numerous set of forty cases of intussusception as seen during from 12 days to 12 years.

moved by enemas, and where the bowels, if left to themselves, only act once or twice a week. In some of such cases an enormously dilated colon has been found after death with superficial ulceration of its mucous membrane, the cause of such dilatation being by no means clear. It must not be forgotten also that a chronic intussusception may exist for many months, and give rise to the symptoms of chronic obstruction. A careful examination of the abdomen should be practised in order to ascertain the presence of a tumour, and to determine if possible its nature, whether due to collections of hardened feces, matting of the omentum and intestines, as in chronic peritonitis, or to the presence of an incarcerated bowel. An examination of the rectum should always be made. (See p. 127.) The possibility of obstruction being due to pressure of an abscess or growth in the pelvis, or to the presence of a foreign body in the bowel, must also be borne in mind.

The value of rectal examination was well shown in a patient of Dr. Dechodets, in whom, with signs of peritonitis, no evidence at all conclusive could be found of the locality of the mischief till an examination of the rectum while the child was under chloroform was made. A mass was then felt rising up the pelvis on the right side, and a diagnosis of appendicular peritonitis, with the appendix hanging over the brim of the true pelvis, was arrived at. An incision as for ligation of the external iliac artery allowed the peritonitis to be turned forward, and the abscess was with some difficulty reached, and opened without soiling the general cavity of the peritoneum, which must have been inevitably done if the abscess had been sought by the usual route. The appendix was felt lying in the abscess cavity. The child was making a good recovery at the time of our going to press.

CHAPTER VIII

DISEASES OF THE DIGESTIVE SYSTEM—(continued)

Tubercular Ulceration of Bowel and Mesenteric Disease

IN the majority of cases of children dying of tubercular disease, tubercular ulcers are present in the intestines, and the mesenteric glands are enlarged and 'cheesy' on section. This association of ulceration of the intestines with cheesy mesenteric glands is so much the rule that it is impossible to separate the two clinically, and it must also be remembered that anatomically the solitary glands and Peyer's patches are lymphatic structures. The frequency with which these lesions complicate phthisis or general tuberculosis is shown by the fact that in 103 consecutive *post-mortems* made at the General Hospital for Sick Children, Manchester, on children of all ages dying of tuberculosis, in 62 there was tubercular ulceration of the intestines, in 21 cheesy mesenteric glands, in 53 both ulcers and cheesy glands existed together, in 7 tubercular ulcers without cheesy glands, in 16 cheesy glands without ulcers. These numbers, as far as the frequency of tubercular ulceration is concerned, do not overstate the fact, as it is far more likely that the presence of ulcers in the intestines, especially if they are small, should be overlooked, than their frequency overrated. These statistics also show the frequent association of ulceration of the intestines and disease of the mesenteric glands, though this association is not constant, and one may be found occasionally without the other. Ulceration may exist without the mesenteric glands joining in the process, but there is a strong probability, amounting almost to certainty, that if intestinal ulceration be present the glands will be found to be affected. On the other hand, it is certain that ulceration is not the necessary precursor of mesenteric disease, for just as a chronic catarrh of the nasal mucous membrane may in an unhealthy subject set up glandular enlargement and abscess, so a catarrh of the intestine, if long continued, is exceedingly apt to give rise to mesenteric disease. Although mesenteric disease is so commonly found in children dying with a widespread distribution of tubercle, it is by no means so common to find tubercular disease beginning with symptoms of *tubercles mesenterici*, as is commonly believed, for in practice it is constantly found that infants and children who have habitually distended abdomens, with more or less wasting, are yet down as suffering from 'consumption of bowels.' In the greater number of these cases there is no mesenteric disease, but a chronic and obstinate catarrh of the intestines which is perfectly curable. Besides the very frequent

association of ulceration and mesenteric disease, chronic tubercular peritonitis is a frequent complication.

Infants and children of all ages suffer from tuberculosis of the intestines and glands, but it is perhaps less common before the age of two years than afterwards. The common cause of marasmus in infants is a gastro-intestinal atrophy rather than tubercular disease, such infants succumbing before the tubercular process is set up, though in some cases cheesy glands may be found. It has just been noted that in at least 50 per cent. of cases dying of tuberculosis, disease of the mesenteric glands was present, and in rather more than 35 per cent. tubercular ulceration was associated with it; it is of some interest and importance to inquire in how many of these cases was the tuberculosis of the intestine and glands primary, and the tubercular lesions elsewhere secondary; and in how many instances the tubercular disease began with abdominal symptoms. A primary tuberculosis of the intestine is suggestive of infection by means of tubercular bacilli taken in food, as, for instance, in the mother's milk or that of a fever nurse, or the milk from a tuberculous cow. Diets experiments in feeding young animals with tuberculous material, or milk from consumptive cows, have demonstrated the possibility of a direct infection taking place, though there have been many experiments with negative results.

Of the 105 fatal cases of tuberculosis referred to above, in 13 or about 12 per cent. the early symptoms were referable to the abdomen; in a few of the cases, symptoms of lung mischief were absent during life, and the lungs were found free from tubercle, or only slightly affected; in the majority of cases the physical signs and symptoms pointed during life to lung complications, which superseded sooner or later, and at the *post-mortem* more or less extensive pulmonary lesions were found, though in some instances these only appeared during the last few weeks or months of life. Tubercular ulcers are most frequently found in the ileum, and in the large bowel, especially in the caecum. In chronic cases they may be very extensive, with much matting together of different coils of intestine and of the omentum by peritonitis. The walls of the caecum are often much thickened. The ulcers, if recent, are sharply punched out; if chronic, their edges are thickened and irregular, mostly running across the gut. The mesenteric glands when affected are enlarged and cheesy; sometimes a few, at other times nearly all the glands seem to have undergone cheesy changes; occasionally suppuration takes place. The ulcers may cicatrize, and by puckering the gut give rise to some obstruction to the passage of the intestinal contents, especially in the large bowel or at the caecum.

Symptoms.—If a child of over two years of age suffers from a chronic looseness of the bowels, with wasting and hectic, there is a strong probability that it suffers from abdominal tuberculosis. This probability passes more or less into a certainty if it comes of a tubercular stock and presents the usual tubercular aspect, such as marked pallor, long curved eyelashes, and excessive growth of fine downy hair upon the skin. The abdomen is usually more or less distended with gas, the superficial veins are enlarged, there may be tenderness on deep pressure, and perhaps some thickening may be felt over the caecum, or some matting of the omentum. The symptoms are often varied according as ulceration of the bowels, mesenteric disease, or chronic

peritonitis is extensively present. In most cases of tubercular abscess there is troublesome diarrhoea, though it must be borne in mind that this diarrhoea in many cases completely stops for a while, or, indeed, may be absent from first to last. There is no special feature about the diarrhoea of tubercular disease; there is a general tendency to looseness, and this may come on after errors in diet, or directly after food is taken, or may appear to be the result of cold. The stools are mostly liquid and brown or yellow with an excessive quantity of mucus and perhaps streaks of blood, but too much stress must not be laid upon the character of the stools. The tongue is usually clean and red, with enlarged and congested fungiform papillae. It is of course necessary to carefully examine the lungs in all such cases, as any confirmatory evidence of tuberculous there would be of great importance from a diagnostic point of view. The course of such cases is often chronic, and they often greatly improve for a while, probably on account of the intestinal catarrh which is present undergoing improvement, or the abscess may slowly cicatrize and heal. On the other hand, there is a constant risk of a tubercular meningitis supervening, or some acute lung trouble carrying them off. Sooner or later, however, the diarrhoea, wasting, and hectic reappear, the child becomes more and more pallid, the abdomen more distended, the feet swollen, and the face puffy. The diarrhoea at the last is often constant, and the desire to go to stool, only a little mucus or liquid feces passing, is very distressing and not easily relieved. The emaciation at the last is often extreme. When symptoms of abdominal tuberculous follow on those of chronic tuberculous of the lungs, the diagnosis is not difficult, and a more rapid course may be predicted. When the tuberculous of the intestines is primary and uncomplicated with other troubles, the course may be very chronic, extending over several years, improvement taking place from time to time.

In rare cases severe hæmorrhages may occur from tubercular ulceration of the intestines. This takes place, as would naturally be expected, in the acute rather than in the chronic cases, or, in the late stages thickening and cicatrization takes place. We have known fatal hæmorrhage from the bowel to take place from a tubercular ulcer of the ileum.

In the following case there was severe hæmorrhæm, and some dark blood was also passed by stool. The case was puzzling, as at the time the vomiting of blood took place there was nothing in the lungs or abdomen to suggest tuberculous.

Case of Tuberculous Ulcer in the Intestine; Acute Hæmorrhæm.—William T., aged six years. He was, it was stated, always a strong boy till sometime before his admission, when he complained that he was lame in his right leg; both knees were painful and swollen. Admitted June 18. He was a well-developed boy; all the organs were normal; his appetite was bad; there was no diarrhoea. The right knee was swollen; there was no point of tenderness on the right side. The evening temperature peaked at 101°; the evening temperature continued raised a degree or two for a few days, and then became normal. He complained for the next week or two of joint pain in his knees. On July 15, after having had a good dinner, he suddenly vomited a quantity of bright blood with large clots and quickly became blackish; soon, during the day he again vomited dark blood. There was some tenderness and resistance on the left side of the abdomen just below the ribs. He continued fairly well till July 18, when he again vomited some half-pint of blood and mucus; there were large quantities of dark blood in his stools. July 21.—He has wound

much in the last few weeks; there is no cough or diarrhoea. From this date till his death the temperature was hectic, varying from 101° to 103° ; 101° was noted in his lungs, especially at the apices, and it was evident he was suffering from acute tuberculosis. He gradually became intensely emaciated; there were no more haemorrhages. He never suffered from any diarrhoea. Death occurred September 27. At the post-mortem, both lungs were studded with clusters of tubercles, becoming numerous at the right apex; the mediastinal glands were crossed. The stomach was healthy; the mesenteric glands were swollen, but not caseous; there were some large, recent, sharply cut tubercular ulcers in the middle of the jejunum, and numerous others in the ileum and large bowel. Miliary tubercles on the spleen and liver. Early tubercular hip disease.

In those cases where the mesenteric glands are chiefly affected the symptoms are still less definite, though this, as has been pointed out, is not often the case, as varying degrees of tubercular ulceration of the intestines and chronic cicatrizing peritonitis are apt to be present. The symptoms are usually those of chronic intestinal catarrh, perhaps without marked diarrhoea, with wasting and hectic. It must be remembered that a distended abdomen which is chronically in this condition, with some wasting and an evening exacerbation of temperature, does not necessarily mean mesenteric disease, any more than the signs of a chronic pneumonia are necessarily to be interpreted as the signs of tubercle; we only infer in both cases that tuberculosis exists if we get confirmatory evidence elsewhere. A history of tubercle in the family, the steady progress of the disease, wasting, great pallor and hectic, would help the diagnosis. The supposed large glands should be carefully felt for, taking care not to mislead fingers in the large bowel or irritations of the mesentery or caecum for enlarged glands. The fingers should be laid on the abdomen below the umbilicus and pushed well in, and gently moved about; the mesenteric glands lie deeply, can rarely be distinctly felt, they are movable, and of size varying from hazel nuts to walnuts. If the abdomen is distended with gas, even large groups of glands may exist, and yet not be felt. An early diagnosis is rarely possible by discovery of enlarged glands; it is only towards the close that they can usually be felt, when the tone of the abdominal muscles is diminished and the intestines more or less collapsed.

Diagnosis.—A child with a temperature raised a few degrees at night, with distended abdomen, chronic diarrhoea, which resists treatment, and has produced wasting and marked pallor, is probably the subject of tubercular ulceration of the intestines. If, at the same time, local induration can be felt in the region of the caecum or in other places, or if there are signs of tubercular disease in the lungs, the diagnosis becomes still more probable. Moreover, the diarrhoea probably persists in spite of liquid diet, rest in bed, and astringents, and is only temporarily kept in check by opium. Mesenteric disease is much more frequently diagnosed than discovered post mortem. A progressive wasting due to chronic intestinal catarrh or gastrointestinal atrophy is frequently attributed to caecal degeneration of the mesenteric glands, and a fatal termination is looked upon as inevitable. It is well, however, to bear in mind that mesenteric disease is uncommon before eighteen months or two years of age, and, moreover, great wasting may be due to intestinal catarrh without mesenteric disease. It is but seldom that enlarged glands can be felt; the diagnosis mainly depends upon the signs of

throughout elsewhere in the body and upon the family history. If there has been much diarrhea with hæmorrhage, and symptoms of chronic peritonitis, followed by extreme wasting, there is good reason to suspect mesenteric disease.

Treatment.—The treatment of tubercular ulceration and mesenteric disease is the treatment of tuberculosis in general. Fresh air and careful dieting are all-important. The special treatment consists in keeping the diarrhea in check, while nourishing food easy of assimilation is being supplied to the patient. The class of foods must be selected from those which contain much nutriment in little bulk, such as eggs, fish, meat, fats, milk, rather than foods containing large quantities of starch and sugar. If there is but little diarrhea, milk may be allowed in moderate quantities, but the amount taken must not be excessive if much looseness of the bowels exist, as too much food taken is apt to aggravate the diarrhea. In all stages of the disease mixed underdone meat, whether chicken, beef, or mutton chop, is of great value. The child's portion may be taken from red juicy meat found close to the bone in a large joint of roast beef. It should be finely minced, cut as fine as it is possible to cut it, and gravy poured over it before it is taken. Of this, large quantities will be taken readily by the children, some curries of stale bread being given with it; but even small quantities of such are apt to disagree and give rise to flatulence. An egg or part of an egg beaten up in milk may be given once or twice a day. The diarrhea is best kept in check by careful dieting, avoidance of more food than the child can digest, and if excessive, the food for a while must consist almost entirely of powdered underdone meat, or meat juice. Small doses of opium combined with assafoetida and chalk may be given. (F. 20, 21.)

In the later stages small quantities of bismuth and starch may be required, but too often the diarrhea is quite uncontrollable. Opium fomentations are useful. If the diarrhea is due to the presence of indigestible food, laxatives such as a powder containing rhubarb and soda should be given. Castor-oil, either as an emulsion or in combination with other tonics, is useful in all stages except when the diarrhea is excessive. (F. 22.)

Congenital Obstruction of the Bowels.—It is not an uncommon occurrence for a newly-born infant to suffer from complete obstruction of the bowels; passing no mæconium, though the rectum may be normal, and shortly after being put to the breast it may vomit, first milk, then bile, and finally mæconium. In the meantime the abdomen becomes distended, the face pinched, and the infant dies in a few hours, or perhaps lingers for a few days. At the post-mortem various obstructive lesions may be found. There may be a stenosis of the duodenum, jejunum, or more frequently the ileum, the gut perhaps being narrowed, or even reduced to a mere band of fibroid tissue which runs along the free edge of the mesentery for perhaps several inches, and opens out again into normal bowel lower down; this contraction of a portion of bowel may have been produced by a fetal peritonitis, or it is the result of a mal-development. In the following case it was apparently the latter:

Congenital Contraction of the Duodenum (Hb. T. B. *Crematula's case*).—The mother was a healthy woman who had had five children previously. The first was still-born; the four others all suffered from symptoms of obstruction, and died on the third day after birth. The sixth child appeared healthy and well-nourished at birth, and during the first two

days onward quite well. For the last two days it was a peculiar colour—a sort of orange-purple tint. It only vomited once shortly before death; it was evacuated before death. At the autopsy the stomach and upper part of the duodenum were distended with fluid; the duodenum was found to be tightly in a valvular closed loop below from the pylorus. The rest of the intestines were still folded though small; the bile duct opened into the duodenum below the obstruction.

In the following singular case there was an obstruction of the jejunum, presumably due to a fetal peritonitis and possibly some chronic inflammatory lesions after birth.

Congenital Obstruction of the Jejunum, Distal Jejunum and Duodenum.—W. M., aged 13 years, born with Mr. C. H. Graham, of Wigan. His mother gave the following history: He was carried at the breast for some months, and during this time he was subject to periodical attacks of severe vomiting; these attacks were much more severe than infants are usually subject to. The vomiting began immediately after birth; the vomited matters consisted of curd and bile. These attacks of vomiting have occurred at intervals of a week or two all his life. On more than one occasion the attacks have been so severe and long continued that his life was despaired of. He has vomited as much as six or eight pints in one night. He went on one occasion, a voyage to the Mediterranean, but had to be landed on the first opportunity, as the continued vomiting had so exhausted him that his life was in danger. Sometimes he would suffer from colic and rumen but did not vomit. Fears of diet, excitement, or worry, all seemed to cause an attack. A physical examination showed a dilated stomach; the abdomen was also more or less distended. The symptoms and physical examination pointed to a dilated stomach, secondary to some congenital obstruction in the upper part of the bowels. The vomiting attacks continued during the next four years, up to the time of his death, when he was thirteen years old. We are indebted for details of his last illness to Dr. Sandilands of Jersey, where he died. He vomited in his final weeks on December 5, 1891, and joined in a game of football. The same evening he had one of his usual vomiting attacks, which was more severe than usual, and Dr. Sandilands was sent for. When seen on December 6 he was evidently suffering from acute obstruction of the bowels; the vomiting was continuous, and nothing was passed per rectum. There was intense colic. Death took place on the fourth day of his illness. *Post-mortem* made by Mr. Graham and ourselves. The body was that of a well-grown lad 13½ years. On opening the abdomen the small intestines were seen to be immensely congested and of a dark purple colour; there was some haemorrhage in the peritoneal cavity; the peritoneum was much injected. The whole of the small intestines were evidently strangulated, there being a complete valvula; the last foot or so of the ileum was wound two or three times round the upper part of the jejunum, the latter being twisted on itself, so that the jejunum, mesentery, and blood-vessels were strangulated; the union was dragged upwards one of its plies. The immediate cause of death was the valvula, probably the result of severe vomiting. A further examination showed the nature of his vomiting attacks. The stomach and duodenum were immensely dilated and hyper-tended, the duodenum looking like a blown stomach; as the junction of the duodenum with the jejunum, the gut was turned down and surrounded by fibrous adhesions for some six inches, and one spot was contracted so as only to admit the forefinger. The fibrous strings were presumably the result of some inflammatory action taking place before birth.

In a few cases a twist in the lower end of the ileum has been found. In rare instances, a new growth or hernia has occurred, or a knuckle of bowel has been found tied up by some band or persistent omphalo-mesenteric duct.

Obstruction of the bowels in infants a few weeks or months old may be due to a congenital lesion which has caused a partial obstruction, which is rendered complete by the impaction of hard curdy feculent matters.

In all cases of vomiting with signs of obstruction of the bowels, a careful examination of the anus and rectum should be made.

Imperforate Anus.—The lower segment of the large intestine, including the sigmoid flexure and rectum, is very liable to important malformations.

In the first place there may be mere malposition, the sigmoid flexure descending on the right side or in the middle line (instead of on the left); this would not necessarily give rise to any inconvenience during health, and would be mainly of importance should there be any disease of the bowel in later life.

The more intrinsically important conditions are the various forms of obstruction of the lower bowel from want of development of some part of it, or the presence of abnormal openings from imperfect differentiation of the digestive and genito-urinary segments of the cloaca.

Several varieties of malformation are found. There may be a well-formed anus, but communication between this and the rectum may be cut off by the presence merely of a membrane which has persisted from the time when the epithelial involution slipped in to meet the intestine. (*Imperforate rectum*.) Sometimes the rectum itself is deficient altogether or for a varying distance, the anus also being undeveloped. In other instances the rectum is well formed, but the anus is absent. (*Imperforate anus*.) In these varieties there is no external opening at all, and the rectum is retained. Sometimes the anus is undeveloped, and the rectum, instead of ending blindly, opens into the anterior or genito-urinary segment, i.e. into the urethra or bladder, or, much more commonly in the female, into the vestibule, not into the vagina, as is commonly stated; the vaginal orifice in these cases is nearly always in our experience seen to be free of the rectal outlet. We have only once met with a case of the rectum opening into the vagina itself; this was in a child kindly sent us by Dr. Cullingworth, who thinks it is not an uncommon condition. Boleslawsky, out of 187 cases, found 35 opening into the vagina or urinary tract, while in 53 there was no anus and the rectum ended blindly; these are the two most common types.

Occasionally a "caldike fold of skin" passing from the scrotum to the anus obstructs but does not close the anus (Cripps). Edge has recorded a rare complete case where the anus was double and the rectum imperforate. We have met with a case where a single anus led up to a double gut above. Rarely there is an abnormal anus in the groin or in communication with the bladder, or, as in a case of Erichsen's, a fistula below the umbilicus; anal, perineal, and perineal fistulae have also been met with as well as congenital stricture of the rectum which was not actually imperforate. (Vide *Prolapsus An*.) As a less important condition mere tightness of the anus may also occur.

When the anus is present, but there is no communication with the bowel, the malformation is often overlooked at first, and it is thought that the child is simply constipated; in such cases purgatives are often given and the child's distress much increased. Constant crying, distension of the abdomen with visible intestinal coils, and subsequently vomiting and collapse come on, and unless an examination with the finger is made and the obstruction discovered the child dies exhausted. On examination it will be found that the finger can only be passed a very short distance; if the rectum is developed and there is only a membranous septum, the bulging of the gut as the child strains will be plainly felt, but should the bowel end higher up this sensation may not be distinguishable.

Where the anus is absent and the rectum ends just above it, as according to Cripps it usually does, the bulging will often be readily made out, but if the rectum ends higher up there may be no impulse; in such cases the perineum is narrow and the pelvic outlet smaller than it should be. When there is no anus the rectum is generally deeper the surface than when an anus is developed, but the rectum ends blindly.

Where the rectum ends high up in the pelvis, a fibrous cord may be prolonged downwards in the position of the natural bowel; this cord was thought by Mr. Curling to represent the rectum obliterated by intra-uterine absorption; its presence, however, is not constant.

When the rectum ends in the urethra there is passage of fluid feces and flatus by the urethra, together with absence of the natural orifice. Subsequently, if the child survives, there is much trouble from obstruction of the urethra by fecal matter and from irritation set up by the decomposed urine. Kelsey¹ points out that if the opening is into the bladder the mæconium is mixed with the urine, while if it is urethral the bowel contents may escape independently of the urine. When the rectal outlet is within the vestibule the bowels may be sufficiently relieved for the deformity to escape notice, and there may be no impairment of health; indeed, the presence of such malformation may remain unknown until adult life. In many cases, however, though the opening is sufficient for the escape of the fluid or soft feces of childhood, it is not large enough to allow the passage of solid motions, and obstruction arises later on. There is no inconvenience of feces in these patients, the internal sphincter preventing involuntary escape.

As in so many other congenital malformations, a large number of children the subject of these deformities do not survive birth. Where, however, a living child is found to have no outlet at all for its intestinal contents, immediate treatment is of course necessary, although it is said that patients have grown up and relieved the bowels by periodical vomiting of feces. As soon then as the deformity is recognised, a decision must be come to as to what is the best mode of relief.

Treatment.—When a thin septum alone closes the gut a simple crucial incision, using a speculum if necessary, and subsequent dilation with a bougie or the finger, is all that is required. The child, if it survives, may in no way suffer afterwards, though we have seen a case of a girl of 10 or 12 years old who had been operated on in infancy and had not got perfect control over the bowels.

Where the separation between the rectum and the surface is greater, bulging of the distended gut should be carefully felt for and an incision made just in front of the coccyx and carried down to the bowel, which should then be freely opened and brought down and sutured to the skin, unless there is so great tension that the stitches are not likely to hold, in which case the opening should be packed with gauze to keep it patent, or a large drainage tube inserted.

If no bulging can be felt, an attempt to reach the bowel should still be made by a similar incision, and the dissection should be carefully carried upwards, keeping well back in the hollow of the sacrum and feeling from time to

time for the bowel. As it is most important that the child should *strangle*, dilatations should only be given during the first steps of the operation, and fortunately this is the most painful part of it. With a similar object it has been advised to delay operation until the bowels are distended. If the gut is found, it should be treated as in other cases, or if it cannot readily be brought down, it must be left but kept patent in a similar way, or a tube may be kept in through which droes can pass. Arnould and Vermeil retracted the coccyx and lower part of the sacrum in order to bring the gut to the surface.

Should it be impossible to reach the bowel from below by dissection, which may be carried to a depth of an inch and a half, in no case must any (first) puncturing with a trocar in hopes of finding the gut be employed; by such means there is much more likelihood of penetrating the peritoneum, especially as it usually descends lower than in normal anatomy. Either Littré's operation of opening the bowel in the groin or Arnould's (Clifford's) lumbar operation must be performed. As there is some uncertainty in all these cases as to the course of the bowel, and as in a certain proportion the colon lies in the middle line or to the right side, it is wiser on the whole to do Littré's operation. The danger of opening the peritoneum is not so unequal in the two plans as might be thought, since there is often a mesentery in these cases, and the anus is much more conveniently placed for self-transposition in after life; there is little choice as the matter of danger between the two. Littré's operation then should be selected. The operation consists in making a vertical or oblique incision about two inches in length in the left groin above and a little external to the middle of Poupart's ligament; a vertical incision is probably the best, since, if the sigmoid flexure does cross to the right, a slight upward prolongation of the incision will enable the surgeon to reach it. The abdominal wall having been cut through and the peritoneum opened, the distended bowel will present at the opening and should be picked up with forceps, and treated as in the ordinary colotomy operation.* If the child can bear the delay in opening the bowel, the operation should be done in two stages as in gastrotomy; to avoid leakage Cripps suggests the use of a coarse thread in stitching the gut to the edge of the wound; the use of a round suture needle answers better.

Edmund Owen has six times performed Littré's operation, twice successfully; three of his cases died from the operation being too late, peritonitis existing at the time. In two of the instances in which we have described colotomy the result was perfectly satisfactory; the children got quite well, but one died some months after of bronchitis. It has been suggested that after opening the sigmoid flexure in the groin, a probe should be passed downwards and an anus made in the natural position with the guidance of the probe. Owen's two successful cases of Littré's operation died after the performance of this second operation, but Byrd and Kretschin have been successful.[†]

Cutting's statistics and opinion are much in favour of the inguinal operation; Cripps' figures are inconclusive.[‡] Huguier's operation of opening

* For a description of the operation we must refer to the general treatises.

† *Edinb. Med. Journ.* Feb. 1845; also *Edinb. Med. Journ.* 1845.

‡ *Edinb. Med. Journ.* 1845; also *Edinb. Med. Journ.* 1845.

the gut in the right groin, on the ground of the more frequent position of the colon on the right side than the left is not supported by Gussak's statistics, quoted by Holmes, where in 432 amputees the colon was in its normal position in 396 instances; in eighty of these Litre's operation had been performed, and in every case the sigmoid flexure was on the left side. Atkin, of Sheffield, records a case in which the small intestine was opened by the inguinal operation, the whole colon being rudimentary; and our colleague, Mr. Whitehead, tells us he operated in the left loin on one occasion and found at the *post-mortem* that the cecum had been opened.*

We have opened a coil of large intestine by right inguinal colotomy in an adult, and found that it was the sigmoid flexure and not the ascending colon that had been secured.

Cripps' table gives the following results :

Of 16 cases of inguinal colotomy	11 died
" 5 " similar "	2 "
" 17 " puncture "	14 "
" 3 " resection of the coccyx	5 "
" 39 " perineal incision	14 "
" 14 " operation for vaginal (i.e. vulvar) anus	1 "
" 5 miscellaneous cases	3 "

Nodehamster records eight recoveries out of twenty-five Litre's operations.

The deaths are mainly due to peritonitis, or failure of relief.

When there is a fistulous opening between the rectum and the bladder or urethra, Litre's operation should be performed, unless the gut can be reached from the perineum, when possibly the communication with the urinary tract may close spontaneously. When the unnatural anus opens in the vulva, in the cases we have seen it has usually been by an orifice in the side of the distended rectum and not by a terminal opening; that is, the rectum has been pushed and projecting below the vulvar aperture. In such conditions a bent probe should be passed through the orifice into the gut and made to press against the perineum just in front of the coccyx. An incision is then made upon the probe, the rectum freely opened and treated in the usual way. Great care must be taken to keep the new aperture patent, otherwise it is prone to contract and the faeces continue to pass both ways. In some cases it is said that the vulvar orifice will contract and close of itself (Holmes). In our own cases we have not found this to occur, and in one of them we pared the edges of the vestibular opening and sutured them; no union, however, resulted, and we afterwards laid open the perineum, dissected away the gut from the vestibular wall, stitched it carefully to the skin, and then sutured up the perineum, with a successful result; the patient was about 6 years old. In another instance we performed the same operation in a child of 9 months, but it died some weeks later of inanition. We have had a third successful case recently in which power of retention seems well preserved. Dieffenbach appears to have been the first to adopt this plan, which, however, is often called Rind's operation. It is, we think, well to

* *Lancet*, January 31, 1884.

* Please advised opening the coccyx.

was until the child is two or three years old before doing the second operation.

One of the difficulties we have met with in these cases is that of keeping the bowels regular even when there is quite a free opening; this we believe to be due to imperfect muscular action, though the muscular coat of the bowel is hypertrophied in some of these cases. Eucassia, castor-oil emulsion, and occasional more active purges are required under these circumstances. Sometimes when the case is one of vulvar stricture a collection of hard feces is found in the intestine above at the time of operation; this requires removal, as the child is often unable to void it even when a good-sized aperture has been made.

Deformities of the Umbilicus.—In some cases of extirpation of the bladder there is no trace of an umbilicus to be seen in after life, the scar being lost in the malformed abdominal wall. In other cases the umbilicus is abnormally large—that is, a considerable part of the abdominal wall is formed by the structures of the cord, and sloughs away when the cord shrivels up so that an actual deficiency of the abdominal wall results. In two cases of this condition we have seen that were operated upon, one by Mr. House and one by ourselves, a portion of the liver protruded through the opening and was covered only by the sloughing tissue. In our own case we dissected away the dead part and closed the abdominal opening by sutures, but without success; in a third case, under our care, the part was simply protected from irritation and left, but this child also soon died.¹ The frequent presence of the liver in the hernia has given rise to the name of *Hepatosphalus*, but the stomach and other viscera are often included in the protrusion.

At the third month of intra-uterine life there is still a coil of intestine lying in the umbilical cord outside the abdominal cavity; should this condition persist, a true congenital umbilical hernia is found. The importance of this fact is that in ligaturing the cord the gut might be included in the ligature and strangulated, a mishap that has actually occurred. In slighter cases there is only a small protrusion standing out from the abdominal wall much like the end of a glove finger; the bowel is reducible and the treatment is that of an ordinary umbilical hernia. In other instances, owing to persistence of the vitello-intestinal duct, Meckel's diverticulum remains open, and passing up to the umbilicus may open there, giving rise to fecal fistula, as in a case of our own where a ligature round the protrusion, followed by the application of strapping to draw together the sides of the orifice, procured closure of the fistula.² Edmund Owen advises emptying the bowel by free purging and subsequent administration of opium, thus giving time for the fistula to close; he applies a dry pad over the fistula and leaves it undisturbed. Sarcini has followed this treatment, but it appears to be applicable to older children rather than to infants. *See patient synchysis &c. vide SURGERY OF THE URINARY ORGANS, and also DISEASES OF THE NAVEL.*

Congenital hiatus of the abdominal wall may occur in other parts besides

¹ Underwood records a case of recovery in which the treatment consisted in probing, and Tanner and others have had successful cases. In a case of Brodie's *Path. Soc. Trans.* vol. ix., besides the hepatosphalus, there was diaphragmatic forula with deficiency of the peritoneum, and a coil of bowel lay in contact with the heart.

² *Vide Diseases of the Navel—Umbilical Polypus.*

the umbilicus from simple failure of closure of the ventral laminae. Of this extraversion of the bladder is an instance. In some cases the recti fail to meet one another in the middle line, and ventral hernia may result with great weakness of the abdominal wall.

Well-arranged pads, applied by means of a belt must be employed to prevent protrusion, or possibly in some cases it may be justifiable to cut down upon and stitch together the margins of the aperture, an operation not of a very serious nature, and not of course necessitating any injury to the peritoneum.

Umbilical Hernia.—Umbilical hernia then in children may be congenital or acquired: in the congenital form it is sometimes due to persistence of the fetal condition where a coil of bowel lies outside the abdomen; in other cases, as already pointed out, it is the result of failure of closure of the ventral laminae.

The acquired form usually appears within the first few months of life; in this case the rupture protrudes not through the centre of the seat, which is occupied by the fibrous remains of the vessels, but usually above it or even through an independent opening in the linea alba. Astley, however, believes that the protrusion is generally through the ring. Both forms of hernia are readily reducible and usually consist of small intestine; the amount of protrusion varies from a mere convexity of the navel to a prominent glomerular-like outgrowth.

The treatment consists in applying a fat pad of wool or paraffin felt about the size of a penny and two or three times as thick; this pad should be covered with flannel and fixed over the umbilicus by a broad band of strapping encircling the body or by a soft webbing belt; we prefer the former, as more efficient and less likely to slip, though it is not so comfortable as the belt. If the pad is worn constantly for from one to three months, according to the age of the child, the hernia is usually 'radically cured.' In cases which obstinately resist treatment the orifice might be cut down upon and sutured. A case of irreducible umbilical hernia containing omentum was successfully operated on by Kockroth in a girl of 14 years;¹ but it is clear that most cases of umbilical hernia in children are cured, since the condition is hardly ever seen in young adults. We have had occasion to close by operation a median ventral hernia in a child. The result was successful.

Inguinal Hernia.—Inguinal hernia is met with in childhood in the following varieties:

1. The funicular process of peritoneum remains widely open and in free communication with the cavity both of the peritoneum and tunica vaginalis: a hernia descending into this cavity is a true *congenital* hernia, or hernia of the tunica vaginalis (Teale).
2. The tunica vaginalis may be shut off from the funicular process at the upper part of the testicle; a hernia coming down into the inguinal process is called a *fluorular* hernia, or hernia into the funicular process.
3. When the same condition as in (2) exists, but the hernia instead of descending along the canal of the funicular process pushes down a separate pouch of peritoneum behind the process, the hernia is called *infantile* or *cryptid*. The same name is given to cases where the funicular process is

¹ *Lancet*, August 2, 1884.

obliterated at the internal ring or just above the testicle, and the organ is pushed down and irrigated into the lower part of the process. In the former case, in cutting down upon the bowel from the front three layers of peritoneum, viz. two fascicular and one sac proper, will be found in front of the gut; in the second case two layers will overlie the bowel.

4. An ordinary acquired hernia may be met with. Hernia may, of course, be complete or incomplete—that is, it may descend into the scrotum or only distend the canal or bulge at the internal ring.

The first and second forms are much the commonest, and it is usually impossible to be certain which is present unless the parts are exposed by operation. Where the testicle is completely wrapped round by the hernia it is probably *congenital*; where the testicle remains a distinct boss upon the surface of the hernia it may be *fascicular*, though it is not by any means always so. We believe the fascicular variety is the more frequent. Infants or encysted hernia can only be recognized by operation, but it may be suspected if, after reduction of a hernia, an unusual amount of thickening along the cord remains, or if there is a hydrocele of the cord or an infantile hydrocele in conjunction with a reducible hernia. Fortunately, an exact diagnosis of these conditions from one another is not of much importance.

Hernia may develop at any age; it is sometimes noticed immediately after birth; in other instances it comes down later when, from failure of health, or bronchitis, or whooping cough, the muscular walls of the abdomen become relaxed, and are in addition overstrained by coughing, violent crying, straining in defecation, micturition, &c. So common is it for straining in micturition to bring down a hernia, that it is quite certain that phimosis is a most fertile cause of rupture.¹ The presence of a calculus or worms acts in the same way. Hernia very commonly accompanies ectopia vesicæ.

As is well known, inguinal hernia is sometimes met with in female children, though not nearly so commonly as in boys. Of 112 unselected cases of hernia seen in our out-patient department, there were—

In males—57 right inguinal, 32 left inguinal, 16 double, and 9 umbilical.

In females—4 “ “ 5 “ “ 40 “ “ 9 (7 10) “

Mr. Leader Williams tells us that in his experience in the Maternity Department of St. Mary's Hospital, Manchester, umbilical hernia is by far the commonest variety, and this is no doubt true of the first few weeks of life.

Most commonly an inguinal rupture in a child contains small intestine with or without omentum, perhaps most commonly without. Other parts of the intestinal canal are, however, not rarely found. We have many times during operation found the cæcum and vermiform appendix in a hernia, and not rarely the appendix can be very distinctly felt through the covering without an operation.² The ovaries in girls and the bladder in either sex are sometimes protruded.

Generally a rupture is easily reducible, but when it is necessary to make the child lie down before it readily goes back; it then often does so spontaneously. Violent crying will sometimes make it quite impossible to safely

¹ An important fact first pointed out by Mr. J. S. Renown.

² Vide papers in the *Brit. Med. Jour.* vol. I. 1887, by Mr. F. Treves, and also by one of the present writers.

reduce a hernia, and the child must be quieted or anaesthetised before reduction.

It must be remembered that, though as a rule herniae are opaque, a tightly distended rupture consisting only of bowel, and that full of fluid, in a thin-skinned child will be distinctly translucent; this fact was, we believe, first pointed out by Mr. House, and we have several times seen it.

Various abnormal conditions may complicate hernia; thus the testis may be entirely retained or have imperfectly descended on the same side. A vaginal hydrocele or hydrocoele of the cord may coexist with a hernia, or fluid in a congenital hydrocoele may distend the sac of a congenital hernia. The rupture, of course, may be single or double, and sometimes of a different species on the two sides. We have seen a 'funicular' and a 'congenital' hernia on opposite sides in the same child. Children the subject of hernia are undoubtedly often affected with intestinal disturbance, which appears to be sometimes at least due to the hernia. It has, however, been suggested by Lane that the hernia is due to the intestinal trouble, and it is undoubtedly true that marasmic children with chronic indigestion and irregular and often constipated bowels not uncommonly have hernia which are not readily cured till the nutrition is improved.

Ruptures in children are occasionally irreducible; when this is due simply to straining, as already pointed out, the difficulty is easily got over, in other cases the hernia may be obstructed by its contents as in adults; again, adhesions to the sac or to the testicle or matting together of bowel to bowel, or bowel to omentum, may prevent reduction. In one of our cases a large hernia was made irreducible by the presence of tuberculous mesenteric glands which had evidently enlarged after their descent, and it was only after removal of some of these and enlargement of the rings that the rupture could be reduced; the child recovered, but evidence of tuberculosis, of course, remained.

It is somewhat rare for a hernia to become strangulated in childhood. We have, however, met with several such cases; they differ in no respect from the similar condition in the adult, but considering the extreme tenderness of the tissues in children immediate operation is the wisest course in preference to treatment by ice, &c. Elevation of the pelvis and abdomen, as well as direct taxis, should, perhaps, be first tried, but very gently; we have known a child die of the injury done to a coil of intestine which was reduced before the child was seen by us, and could only have been strangulated for a few hours. The youngest cases with which we are acquainted were one of three weeks by Halsewood, and another successful one of our own, and one of four weeks by Mallader. The sac always requires opening, since the neck itself forms the constricting part. Sometimes in an hour-glass sac the constriction may be in the scrotum.

The treatment of hernia in children resolves itself into three questions—first, the removal of all causes tending to produce rupture, such as cough, pleuritis, &c.; secondly, treatment by apparatus; and lastly, operations.

Ruptures in children sometimes get well of themselves without treatment, or simply by keeping the child lying down and avoiding disturbance of its

temper and bowels. In other instances circumcision will prevent further descent of hernia by removing the source of straining.

Failing these means, the wisest plan is at once to provide a well-fitting truss, a matter which should be seen to by the surgeon himself, and not left to an instrument maker. The truss must be worn night and day without intermission, never being removed on any account for washing or any other purpose except to put another on; this is necessary, because the truss in children used to cure rupture, and not merely to palliate it as in adults. When it is absolutely necessary to change a truss, the new one must be got ready, the finger slipped beneath the old one to keep pressure upon the canal and then the truss changed, the child being kept on its back and soothed to prevent crying. During the treatment the skin must be carefully washed and kept dry and un irritated by the free use of boracic acid powder; this can be dusted beneath the truss without removing it. A little judicious jacking with absorbent wool will serve to take pressure off any tender part. Almost all hernia during the first year of life that can be kept up without more coming down for three months will be permanently cured; after the first year a longer time is required.

The ordinary flat pad trusses do very well if the parents can afford to frequently renew them, but they get stiff and hard, and the springs soon rust and run with the frequent leakage of urine, so that they have to be frequently changed, and a duplicate should always be at hand in case of sudden going away. One descent of a hernia undoes all the preceding treatment; this is the cardinal rule to impress upon the mother or nurse. The inflatable and the glycerine pad rubber trusses we have found useful and satisfactory when carefully managed, and they are not affected by urine nearly so rapidly as the common truss, but they require careful inspection from the first, as they are often imperfectly made, and flaws or tears are soon fatal to them. The hard rubber truss is sometimes spoken well of; we have not tried it. If from bad management a sore is produced by truss pressure, careful padding will often avoid the necessity of leaving off the truss; but with proper attention and care that the truss spring is not too strong, it seldom occurs.

Hydrocele and orchitis we have more than once seen as the result of wearing a truss; in such cases we may be sure that the spring is too strong and a different truss must be applied. Spica bandages, wool trusses &c. are inefficient substitutes for a good truss. The pad of the truss should be flat and not convex, and peaked trusses are never required; the object will prevent the hernia from entering the canal, not merely to cover up the rupture.

When a fair trial has been given to trusses, different sizes being, if necessary, employed, and all sources of irritation have been removed and still the rupture cannot be kept up, an operation for its permanent cure should be performed; it is of course required in only a small percentage of cases.

Of all the various plans, the one we think simplest and as good as any, and the only one we shall describe, consists in making a free incision into the canal and upper part of the scrotum, cutting down to the sac, reducing the hernia, closing the neck of the sac, and passing silver wire or silk strands through the walls of the canal and twisting them up. To do this the sac

must be opened and the finger passed into the abdomen to make sure that the canal is clear and to guide the needle. The needle, which must be in a bundle, is passed through one side of the canal, and guided by the finger is brought out at the ring; it is threaded with wire and withdrawn, then unthreaded and passed through the other side, then threaded with the other end of the same wire and again withdrawn; two or three sutures are passed in this way till it is felt that there are enough to close the canal, the wires are then twisted up, cut short and their ends well turned down into the tissues. One edge of the sac close up to the wires is then picked up and threaded upon the needle, and successive portions of the surface of the sac are pinched up and transfixed (like threading them upon a skewer) until the other edge is reached; the needle is then threaded with tangle or silk and withdrawn, leaving the ligature, which when tied puckers up the sac into closely applied folds which soon adhere, and the sac is thoroughly obliterated; by this means all trouble and disturbance in separating the sac from the cord is avoided, and the closure is quite firm and complete. Sometimes we ligature the sac before closing the canal; this is not quite so easy, and it is not a matter of importance. The silver-wires are left permanently unless they set up irritation, when they are removed as soon as they are loose, but this seldom happens. The wound should be closed, and will heal by primary union. Of late we have used silk in preference to wire, but it requires careful preparation; if not thoroughly scordized, a troublesome abscess is likely to form, and the suture finally comes away. We prefer to select the particular mode of operation most suited to the case, rather than to confine ourselves to any one method exclusively. There is sometimes a great deal of swelling after the operation, but this gradually subsides and should be looked upon as a good sign of firm consolidation. For the methods of managing complications of the operation we must refer to the ordinary text-books, for unsuccessful results to the chapters on that subject. An omental sac may be met with; we have seen a very perfect instance. The management of such cases and of adhesions differs in no way in the child from that of similar conditions in the adult. It is better not to allow a truss to be worn after the operation unless there is some special reason for it.

The operation is not free from risk and not always successful; we have had one death from peritonitis coming on some time after the operation, and have had to operate more than once in several cases. In the fatal case the canal was perfectly closed and the peritoneal surface almost undisturbed.

Femoral hernia in children is very rare, we have never seen a case; one recorded by Sabourin in a premature female infant was readily cured by a truss. E. Owen saw one in a boy of 10 years out of 748 cases of femoral hernia.¹ Diaphragmatic hernia is occasionally met with.

Prolapsus Recti.—Slight degrees of prolapse of the rectum are common in children and are often only transitory, occurring perhaps once or twice and off again; the more severe forms are much rarer.

Prolapse of the rectum consists in protrusion of more or less of the rectal wall through the anus. The slight and most common form is simply a pushing out of a ring of mucous membrane, which is readily reducible and

¹ *Lancet*, Jan. 6, 1884.

often only comes down when the child strains. In other cases the whole of the rectal coats from mucous membrane to peritoneum may be protruded.

The first variety of prolapse is usually about half an inch long and appears as a red mucous ring with radiating folds diverging from the central orifice; the mucous and catarrhus surfaces shade off into one another at the margin of the protrusion. The second form is larger, reaching from one to two inches in length, and is often conical in shape, its base being at the anus; the folds are not radial but annular, running round the prolapsed part; the orifice is central, and on passing the finger into it, it is evident that the whole thickness of the bowel, and not merely mucous membrane, is involved in the prolapse. Sometimes this form of protrusion reaches much larger dimensions, even six inches in length, and in such cases necessarily a large pouch of peritoneum is carried down, and this is more extensive on the anterior than the posterior aspect of the bowel. In one case that we examined *post mortem* there was a definite diverticular pouch with a sharp limited edge projecting from the recto-sigmoid hollow down the anterior wall of the rectum; it seemed to us probable that the presence of a coil of bowel in this pouch would have much to do with keeping down the prolapse.¹ Not only small intestine but the stomach even may be found in this peritoneal pouch, which then becomes the site of a rectal hernia; the characteristic gurgling or the presence of a solid body felt on manipulating the wall of the protrusion may give a clue to the extent of the disease. Rectal hernia sometimes comes down behind the bowel, or may even protrude through a gap in the muscular coat (Kelsey). This variety of prolapse is sometimes cured as a result of traction by the mesocolic fold of peritoneum or the attachment of the rectum to the vagina. (Van Duren.) In it also the mucous and catarrhus surfaces shade off into one another, though the transverse folds of mucous membrane on the surface of the prolapse may somewhat obscure the line of junction.

A so-called third form of prolapsus recti, where the upper part of the rectum or the sigmoid flexure is invaginated into the bowel below and protrudes from the anus, is recognised by its size and by the presence of a sinus between the prolapse and the anal margin. This condition, however, is more naturally considered as an intussusception than as a prolapse.

The mucous surface of the protruded gut may be nearly natural, but more often is excoriated and coated over with a thick slimy mucus; it sometimes becomes congested and may even slough down irritation or constriction by the sphincter, though in most cases the anus is so lax and patulous that the existence of a sphincter at all is hardly felt by a finger passed within the opening. Bleeding in small amounts often occurs, and there is much mucous discharge.

The motions come away freely, but the irritation and discharge weary the child, and he loses flesh and breath. In most cases the prolapse is reducible with more or less difficulty, less often it returns immediately pressure is taken off; in others it remains up until the child strains from any cause and then redescends; in others again the protrusion after a time becomes irreducible from matting together of the parts and from congestion.

¹ The specimen from this case is in the Owens College Museum; this defectiveness is, as far as we know, undescribed hitherto.

When a rectal hernia exists it is subject to all the conditions of an ordinary inguinal hernia, i.e. it may be reducible or strangulated, &c.¹ Occasionally the prolapse sloughs and fecal fistula results, or the wall may burst in attempts at reduction.

The causes of prolapsus recti are many, though it is obvious that there must be some weakness of the sphincter and levator ani or relaxation of the rectal walls in these cases, or prolapse would be much more frequent than it is. Any condition that produces violent and constant straining may bring on prolapse in a child predisposed to it. The child is generally miserable and weakly when seen, but this is no doubt partly the result of the irritation. Polymia, contracted meatus urinarius, stones in the bladder, cystitis, constipation, diarrhoea, worms, polypus recti, violent coughing all may cause prolapse. Boeckel believes stricture of the rectum to be a cause, and in one case we found a tight annular stricture of the rectum about one inch from the anus; this only admitted the tip of the index finger in a child of about three years old; the stricture apparently formed the apex of the prolapse and may possibly have been a result rather than a cause of the protrusion.

The diagnosis of prolapsus recti is easy where the protrusion is large; the only doubtful point is what extent of rectal wall is included in it. If small it can only be mistaken for piles or polypus; the former are exceedingly rare in children and never form a complete ring, the latter is of course a single isolated, usually pedunculated swelling; a mistake can only occur from lack of examination. Kelsey lays it down that any prolapse over 2½ inches in length contains peritonaeum, while the presence of a *sacculus* serves to distinguish between the second form and the rectal intussusception. The direction of the folds and the size distinguish between the first and second varieties.

The treatment of prolapse consists first in removing the cause of straining, next the child should be kept rigidly lying down in bed; the protrusion must be reduced each time it comes down, and if it constantly recurs an attempt should be made to keep it up by a pad and T-burlesage, or by strapping the buttocks together with a broad piece of plaster. The bowels should be kept easily open so as to avoid straining, and it is sometimes useful to support the sides of the anus during defecation by pressure or by drawing the skin tightly to one side; as advised by Van Linn, the nates should be pasted into a napkin without the child being allowed to sit up.

Enemata of cold water or astringents, *marin*, *quassia* (½ oz. of the infusion), oak bark, sulphate of iron, &c., will do good in many cases, and it is only the more severe forms that are not cured by bed and the means above described; indeed, simple confinement to bed cures the majority of these children. Should the prolapse be irreducible, an anæsthetic should be given; if this fails and there are no urgent symptoms, a warm fomentation and putting the child, if old enough, upon his hands and knees with the pelvis tilted, will sometimes succeed.

If sloughing occurs the prolapse may be protected from irritation, and dressed over with boric- or salicylic acid, and kept clean. The sloughing

¹ Ellis Kelsey, in an elaborate paper in *Archives of Pediatrics*, 1895.

will very likely cure the prolapse, but it may be at the expense of causing a stricture, and this, if it is at the apex of a long prolapse, will be high up in the rectum when the protrusion is reduced.

Failing milder measures, the actual cautery should be employed, four or five narrow lines being drawn in the long axis of the gut from skin margin to near the apex.

Pappelet's cautery is the most useful instrument, and is better than nitric acid or nitrate of silver. Only the mucous membrane of the prolapse should be burnt through, while at the skin margin the cautery should be loose the sphincter; sufficient irritation must be produced to procure adhesion between the mucous and muscular coats. Bryant advises the application of nitrate of silver over the whole surface. After the application the bowel should be reduced and a pad applied. Another useful plan is to excise wedge-shaped strips from the margins of the anus, including a bit of the mucous membrane, the base of the wedge being at the anus; the edges of the wounds are then brought together, and the resulting contraction supports the bowel. We have found this successful in a very severe case. In severe and intractable cases the prolapse has been clamped and removed, but this should only be done as a last resource and with the full knowledge that in a large prolapse the peritoneum will probably be opened, and the utmost care must be taken to reduce anyortal hernia that may exist. If the peritoneum is wounded it must be carefully closed with catgut sutures. This operation is rarely justifiable; we have once done it but unsuccessfully; it is not to be confounded with the method of treating prolapse by removal of strips of mucous membrane in the long axis of the gut by means of the clamp, a method sometimes employed.¹

The bowels should be open two days after operation, as delay makes the first action very painful.

Fistula in Ano is an uncommon condition in children, though we have several times met with it. As in adults, it is apt to be associated with tuberculosis. As pointed out by Mr. Holmes, most of the *fistule* are blind external ones; this is also our experience. There is nothing peculiar in either the pathology or treatment, which is the same in children as in adults.

We have, however, recently introduced the plan of dividing the sphincter and subcutaneously close to its attachment to the tip of the coccyx, and then scraping out the fistula. This is a less severe way of dealing with fistula than the ordinary plan, and is probably sufficient for all cases likely to be met with in children.

Piles in children are usually described as unknown, or almost so, and their occurrence is no doubt very rare; we have, however, seen two cases of external piles, and Ogston, jun., has recorded a case in a child 2 days old. In another instance a child was brought to us for bleeding from the bowel, and on examination a condition indistinguishable from that of well-developed internal piles was found; this had been giving trouble since the child was about a year and a half old, but the affection was probably congenital. Light was thrown upon the case by the presence of a large partially

¹ Dr. Collingsworth related at the Pathological Society of Massachusetts, December 1886, a remarkable case of complete excision of a large prolapse in a young lady in which the peritoneum was opened.

degenerated mucus on the bowels, *quæ dissemis*, and at a distance from the anus, and probably the case was really one of mucus of the anus. The disease was readily cured by applying ligatures just as for piles. There was no mucus higher up, though this is occasionally met with. Ligature or the actual cautery is the best treatment. Howard Marsh and Barker have recorded instances—in one the patient, an adult, ultimately died of hæmorrhage.

Condylomata frequently occur in children about the anus or its neighbourhood as flat, sessile, pink or pinkish-white elevations, or sometimes as large irregular masses. They are usually a manifestation of congenital syphilis, but sometimes, we believe, simply the result of dirt and irritation. When syphilis the local treatment is, of course, subordinate to the general measures, but dusting over with calomel or the application of black wash usually speedily cures them. Sometimes, especially if non-syphilitic, they are more obstinate, and may require to be scraped away or treated with the actual cautery, nitrate of silver, or chromic acid.

Polypus of the Rectum is one of the diseases which, though not absolutely peculiar to children, are by far most commonly found in them. Most cases of rectal bleeding in children, apart from that due to more serious and diarrhoea, are due to polypus; hence careful search should be made for a tumour in all cases where unaltered blood escapes from the bowel.

Rectal polypi are usually pedunculated rounded bodies about the size of a hard nut; they are composed of mucus-filamentous or soft fibro-cellular tissue, or in some cases are adenomatous; in the former form the surface is smooth, though sometimes superficially ulcerated or excoriated, and the pedicle is often long and thin, though the growth in its early stages may be sessile. Adenomatous are granular or warty in appearance. The anterior wall of the rectum about an inch from the anus is the usual seat of these growths; sometimes, however, they are attached higher up in the bowel, and may be even beyond reach of the finger.

Polypi, besides the loss of blood, give rise to irritation and tenesmus, together with a mucous discharge from the gut, and frequently to prolapse. The growth itself is often protruded from the anus during straining, and is sometimes mistaken for prolapse or piles; examination, however, readily enables a diagnosis to be made, as the polypus is quite separate from the general mucous surface. The pedunculated form is best treated by simple twisting off, or a ligature may be applied to the pedicle, which is then snipped through with scissors; to do this conveniently the child should be anaesthetised, and the rectum well dilated and a speculum used; often during an examination the pedicle is torn through and the polypus comes away without further trouble, and occasionally the mass is detached during defecation and passes with the motion. The sessile form may be ligatured or snipped off and its base cauterised. Recurrence of the growth is rare.

We have met with rectal polypus in two members of one family, and Gripps relates similar cases.

Occasionally the whole mucous surface of the lower bowel is the seat of warty adenomatous growths, as in a remarkable case recorded by our colleague Mr. Whitehead. Dermoid cysts have also been found.

Small superficial ulcers and fissures about the anus are common in dirty

and in syphilitic children, but they are more common at a little distance from the orifice than actually at the anus. They give rise to pruritus, but add to the severe symptoms seen in adults; sometimes there is reflex irritation of the urinary organs, frequent micturition, &c. In the non-syphilitic cases, cleanliness, the destruction of worms or other irritants, and the application of nitrate of silver are usually sufficient. Mercurial has been recommended to the proctitis. Tuberculous ulcers may be met with. Ischio-rectal abscess is not very uncommon, and should be opened early; it is probably better to divide the external sphincter at the time to avoid the risk of tedious healing or the formation of a fistula.

Rectal ulcers are due to either follicular inflammation, in which the rectum is involved in common with the rest of the lower gut, or to anal cancer or the presence of a polypus. The symptoms are seldom marked, and the condition is consequently not often seen; *vide* also PROCTITIS and DYSENTERY.

Removal of irritation and improvement of the general condition of the intestinal mucous membrane are the only treatment required.

CHAPTER IX

DISEASES OF THE DIGESTIVE SYSTEM—(continued)

Malformations and Deformities of the Digestive System

Hare-lip.—The upper lip is developed from the fronto-nasal process and the maxillary processes which in the normal course of development fuse to form the mandibular fissure. Should this fusion fail to take place on



Fig. 11.—Shows the lines of union of the face, and indicates the origin of the chief malformations: *from*—*pt.*, *st.*, situation of congenital anterior Stasis; I, II, III, IV., indicate the position of the origin of the maxillary Stasis; E, is the external auditory meatus; M, the mental bone; *mp.*, the mandibular bone; *mp.*, the line of lateral fusion; *st.*, *pt.*, mark the situation of congenital cervical Stasis. (*From Elliot Watson, Lancet, Vol. 1, 1912.*)

either or both sides, a single or double hare-lip respectively results. If the inward growth of the palatine processes which should take place to separate the nasal and buccal cavities fails, cleft palate occurs.

The *præmaxilla* are formed from the globular processes forming the angles of the fronto-nasal process; hence, should the buccal process not fuse with the globular, a cleft between the *præmaxilla* and the *maxilla* will result on that side, while, if there is suppression of the two globular processes and septum, median hare-lip follows; this, though exceedingly rare in man, is met with more or less constantly in some mammals in which the globular processes fail to unite with one another.¹

As to the actual causes of such arrest of development much controversy exists. It is commonly asserted that frights and shocks of various kinds, as well as strong *maternal impressions* of other sorts occurring about the time of the development of these parts, may determine the arrest of growth which results in such malformations. Although many instances have been brought forward to show a causal relation between the two facts, it is not clearly established that anything more than a coincidence really exists.

It is, however, certain that in many cases there is an *hereditary tendency* to such defects, and it is also certain that they are often associated with other congenital malformations. It is asserted that the hereditary tendency is commonly transmitted on the father's side.

Various degrees of hare-lip are found. Mr. Lucas believes that congenital absence of an upper lateral incisor is sometimes the forerunner of hare-lip and cleft palate in a later generation; in some instances there is merely a deficiency of the muscular fibres of the orbicularis, so that although the lip is not actually fissured there is a furrow from the absence of muscle and the consequent thinning of the lip which at the affected part consists only of skin and mucous membrane, often somewhat imperfect in structure, together with an intervening layer of connective tissue.

In other cases there is a shallow notch in the prolabium or at the anterior nasal orifice, the parts being otherwise well formed. Between these conditions and the most severe forms of hare-lip all degrees of deformity may exist (figs. 19 and 20).

As the superficial structures are developed more or less independently of the bony framework of the face, hare-lip may occur without any cleft of the palate, and without any separation of the *præmaxilla* from the *maxilla*. Most commonly, however, if the hare-lip is complete, i.e. if it extends into the nostril on one or both sides, there is also deformity of the bones, either non-union of the *præmaxilla* or single or double cleft palate. Thus there may be a mere notch in the line of the gum, a cleft through the alveolar margin on one side, a cleft running backwards, on one side of the nasal septum through the hard and soft palates, or a double cleft isolating the *præmaxilla*.

¹ *Phil. Acad. Nat. Sci., Trans.*, February 18, 1888.



FIG. 19.—A simple case of diastema between the upper incisors. This is much rarer than the common variety.

from the maxilla and leaving it protruding from the end of the nasal septum while the two halves of the hard and soft palate are completely separated and the nasal septum is seen in the middle line as a prominent ridge and attached to either side of the palate—complete or double-cleft palate—the septum is often seen to taper off and end as a ridge upon the upper wall of the pharynx. It is usually said that cleft palate is always single, but the term may well be limited to those cases where the septum is attached to one palate process only. In other instances the failure of union may occur only in the soft palate, more often in the soft with just the posterior edge of the hard palate, or in slighter degrees of the deformity still the uvula alone may be left, or the palate perforated. In some recorded cases the uvula has been absent.

Two other conditions associated with hare-lip and cleft palate respectively are of extreme importance as regards successful operation; the one is the flat, wide, distorted ala of the nose found in complete hare-lip; the other is the pitch of the palate arch, which may be either wide and flat or very high and narrow; the latter condition is said to be often associated with mental deficiency.

Sometimes the premaxilla carries the four incisor teeth, and these are therefore impeded in the projecting mass in cases of complete double hare-lip. In some instances, however, one incisor tooth is attached to the maxilla, most commonly the outer tooth is suppressed altogether, its side having apparently been lost in the cleft.



FIG. 10.—Severe Double Hare-lip. Showing the protruding premaxilla.

Rotation of Premaxilla.—Very frequently there is some rotation of the premaxilla upon a vertical axis, especially in unilateral cleft; in such cases the teeth are also rotated and may be so directed that the outer border, or in some instances the cutting edge, looks directly forwards. This position of the tooth requires to be remedied after their complete eruption. As, however, hare-lip is now usually operated upon before the teeth are cut, their exact position is in such cases of little importance at the time.

Feble Vitality.—The deformity of simple hare-lip unaccompanied by malformation of the palate is important almost solely on account of the disfigurement, though it must be borne in mind that many of these children have other deformities or are weakly, and, though without any actual malformation, do not seem to have sufficient vitality to make it possible to treat them.

When, however, the failure of the union affects the palate as well as the lip, other ill results follow; the child is unable to suck from inability to produce a vacuum in the mouth; its nasal passages and pharynx are exposed to the air and become affected with chronic catarrh, its tongue is dry and the air

entering its lungs is imperfectly warmed. Even when fed with a spoon the food often regurgitates through the nose. Hence to the already weakly condition of the child are added the dangers of insufficient nutrition and catarrh of the respiratory tract. It is not, therefore, to be wondered at that only a small proportion of children so affected survive; should they do so, they are subject to the further drawback of imperfect and indistinct speech. It is alleged that many of these children die from starvation, which might be prevented by operation; we do not think this is true; we believe they would die in any case from simple lack of vitality.

In those cases where the child is unable to suck, it should be fed in an upright position, when the milk is less likely to regurgitate through the nose, or one of the special obturator tents devised by Mr. Mason and others employed; probably the best of these is Oakley Cook's rubber tent.

The treatment of hare-lip is necessarily purely operative; several important questions have, however, to be considered in each individual case. First, it is clearly of no use to operate on an infant that is incapable of living from the presence of some other deformity incompatible with life, nor in cases where the general health of the child is feeble and it is losing weight, since union of the wound would not take place. No operation then should be done unless the child is in perfect health, and the time of actually curing a tooth should be avoided.

Age for operation.—Next comes the question of the best age for operation. On the one hand it must be borne in mind that there is a certain amount of risk attending the necessary loss of blood and the shock in a very young infant, and on the other hand that, if the deformity is severe, the effect of closing the cleft in the lip as regards moulding the subjacent parts into their natural shape will be greater the younger the child and the softer the tissues. As has been well shown by Dr. Randon, of Liverpool, and others, a most remarkable moulding process in the outline of the upper jaw takes place after closure of a hare-lip, and more than this, the width of the cleft in a divided palate is much reduced after a time by uniting the lip.

Increased facility in feeding and the removal of a hideous deformity are other reasons for early interference, while experience shows that early operation is not attended with a specially high rate of mortality. Many infants die shortly after the operation for hare-lip, but in most of these death is due to malnutrition, not to the operation.

The common practice now is to operate at any time after the first three weeks of life in the less severe cases, and a month or two later in the more serious deformities, double hare-lip being dealt with later still; operations are, however, often successfully done within the first few days of life. Our own preference is not to operate before a month in single hare-lip, nor before six months in severe deformity.

Operation.—It is, in our opinion, much better in all cases to give chloroform for the operation. The coronary arteries should then be controlled by binding knops or finger pressure, and the lip very freely detached from the maxilla, the dissection being carried far outwards along the jaw, upwards nearly to the lower margin of the orbit, and inwards and upwards so as to freely detach the ala nasi from the subjacent base.

The extent of the separation will, of course, depend upon the severity of

the case; but, as a rule, failure is more often due to insufficient separation than to any other single cause.

The bleeding during this part of the operation is often free, but is easily controlled by pressure, and stops immediately after the stitches are put in; for this reason we sometimes pass the edges of the cleft before freeing the lip, though if the paring is done last it is easier to adjust the edges exactly. It is very important to slice away the sides of the cleft freely, and not merely to scrape them or take away a thin shaving; too little is much more often taken away than too much.

In adjusting the edges of the wound, the chief points to attend to are that the prelabial margin on one side exactly corresponds with that on the other; secondly, that the highest suture is well within the nostril, so as to prevent a gap at the upper margin, and to remedy the tendency to flattening of the nostril; thirdly, to insert a suture on the inner and under (verruous) surface of the lip; this more than anything else prevents the appearance of an unsightly notch at the lower end of the line of union. The main sutures should be made to include the whole thickness of the lip except the median mesial line; the intermediate ones may be only superficial.

Silver wire sutures, usually about three in number, with intervening horse-hair stitches, will be found very successful, and are, we think, on the whole, the best.

Hare lip pins are hardly ever necessary, and should not be used if it is possible to avoid it. We have not used them for years. If the lip is freely separated from the upper jaw, there will be no tension. We used sometimes to put pins in temporarily to keep the parts in apposition while the rest of the stitches are being inserted, and then remove them at the end of the operation. If the pins are left in, it should be for not longer than forty-eight hours; the rest of the stitches may be taken out a day or so later, according to the amount of irritation set up and the condition of the child. Where the power of repair is feeble, the sutures should be left in longer. Some surgeons prefer silk or cat sutures. The first stitch, if pins are not used, should be put in opposite the prelabial margin; this answers the double purpose of controlling the coronary arteries and of fixing the level of adjustment of the two sides. If key-pins have been used for controlling the bleeding, they should be removed just before putting in the stitches.

Some surgeons apply a strip of strapping over the lip after the operation, or use a Harembly's truss; neither is necessary. We prefer to dust the wound over with boric powder and leave it exposed. The strapping is objectionable in that it tends to collect blood and serous discharge from the nostril, and so to irritate the wound. It is, however, sometimes wise to put plaster up for forty-eight hours after removing the sutures until the union is quite firm, and it is a good plan to lay a narrow strip of lint over the line of union beneath the plaster.

If the child has not been weaned before the operation, it should be allowed to suck as soon as it recovers from the chloroform; in such case care must be taken to prevent injury to the mother's breast from the wire sutures. In most cases, however, the child has been bottle or spoon fed.

In any case the hands must be carefully secured by bandaging them to the chest with a flannel bandage or by some similar means, and watch kept that no injury is done to the lip.

The principal methods of operating for single hare-lip are as follows; each case must be managed according to its special needs, no one method answering in all cases:

1. The edges of the fissure are simply pared by a straight incision and brought together. This, though answering well in some cases, is apt to leave a notch at the probial margin unless there is abundance of material to work with. By making the line of incision slightly curved, with the convexity towards the cleft, the notching may often be avoided (fig. 21, *e, f*).

2. The single flap method shown in fig. 21 (*b, d*) is often useful.

3. Malpighi's operation of turning down two opposed flaps may be employed; it is chiefly useful for cases where a notch remains after previous operations (*a, c*).

4. Perhaps the most generally applicable methods are those shown in fig. 21 (*b, d, e, f, c*).



Fig. 21. Diagrams slightly altered from *Lancet* (December 29, 1894) to show the modes of re-joining and making the edges in single hare-lip. In *a, b*, the angular incision allows two flaps to be turned downwards. In *c, d*, a single flap from the left side is bent to the opposite side. In *e, f*, the edges are pared, making the line of incision strongly convex towards the cleft. *g* shows Malpighi's form of "triangular operation" (vide text). (After *Lancet*, December 1894.)

5. The more complicated operations of Guillelmi and Collin are seldom employed, but it is occasionally very useful to carry the incision round the ala of the nose in severe cases; by this means the depth of the lip can be greatly increased; this plan was, we believe, first employed by Dr. Russell of Liverpool. Many other methods are described. Owen's is very good.

In double hare-lip two special difficulties have to be met, the management of the prelabium and of the paramidula. The prelabium may be—

1. Pared at its sides and free extremity so as to make a massicular or tongue-shaped flap which is fitted between the upper parts of the two lateral flaps, these having been previously pared.

2. If long enough, the prelabium may be brought down to make the central part of the lip, being pared only at its sides, and the lateral flaps are then fitted to it instead of to each other.

3. The central flap may be removed altogether, and the two sides brought together throughout their whole length.

4. The prelabium, having been dissected away from the paramidula, may

be doubled upon its base and turned up to form a column for the nose. The first and second of these plans are the most generally useful.

The premaxilla in some cases may be pushed gradually backwards by constant pressure with a pad before the hare-lip is operated on, or it may be freely pushed back at once; this is open to the objection pointed out by F. Mason, that the wedging back of the premaxilla may tend to keep open the cleft in the palate. Removal of a wedge-shaped piece from the septum and/or of lateral pieces from the premaxilla is a plan sometimes adopted. The method we prefer where the premaxilla cannot be moved is to shell out the bone, leaving the maxilla prominent to preserve the outline of the lip, and then bring the lip together;¹ this, we think, is certainly better than entire removal of the premaxilla, which produces flattening of the lip. Where the premaxilla is turned upon a vertical axis so that one edge looks forwards it may be freely rotated into position, but if the lip can be sealed over the projection the prominence will, as already pointed out, soon diminish.

Any notch left at the free margin of the lip or at the nostril can usually be closed by a subsequent operation. Should primary union fail throughout, an attempt should be made at once to procure secondary adhesion by either putting in fresh sutures, or, if the tissues are too soft and inflamed to hold them, by applying strapping to bring the sides together. If the child's health is good, this will probably succeed; failure is, however, often due to malnutrition; in such cases union cannot be expected to occur, and a second attempt should be put off until the health is improved. It is wiser not to operate too soon a second time; many cases that look unsatisfactory after operation improve with time.

The particular mode of operating must be selected for each individual case, looking especially to the size of the central portion of the lip in double hare-lip and to the inequality of the two sides in the single deformity.

Cleft Palate.—The varieties of cleft palate have already been mentioned. The severer forms are commonly associated with double hare-lip—indeed, it is said to be very rare for double hare-lip to occur without cleft palate, and no doubt this is true in the complete forms of hare-lip.

Here a brief account of the modes of treating the deformity can alone be given.

For choice the operation should be performed between the fourth and sixth years, but in the less severe cases it may be done as early as the third year; before this it is not wise to attempt it,² unless in exceptional circumstances, since the risk both of failure of the operation and of the child's life is much greater, though some surgeons advocate operation in the second year. As in all plastic operations, care must be taken that the child is in good health. The other general rules to be observed are: the edges of the cleft must be freely pared, all tension must be carefully avoided, the mucoperiosteum must be thoroughly homœostated at the junction of the hard and soft palates in cases of cleft of the velum alone, no hard food must be given till union is complete, and if the operation is only partially successful or fails altogether, another attempt should be made at the end of three months.

¹ This method was introduced by Sir W. Ferguson.

² Mr. Cheate has operated successfully in two favorable cases of cleft of the soft palate at 12 months old. *Lancet*, June 5, 1879.

Staphyloplasty, or the operation for closure of a cleft of the soft palate, consists in freely paring the edges of the cleft throughout, then a sufficient number of sutures are passed, and next the attachment of the soft palate to the hard is carefully loosened, and finally, the palate muscles having been divided to relieve tension, the sutures are tightened up. The exact mode of operating that we prefer is as follows. The child is anaesthetised, a pillow is placed beneath the shoulders, and the head allowed to fall right back so that the roof of the pharynx is almost horizontal; in this position light enters the mouth well, and the blood and saliva collect in a pool in the pharynx instead of irritating the larynx. A gag is then inserted, the whole of the cleft carefully pared, and then from four to seven wire sutures are put in in the following way: a slightly curved needle in a handle is passed through the edge on one side into the cleft, it is then threaded with wire and withdrawn, the wire is disengaged, the needle passed similarly through the other side and threaded with the end already passed; this is then drawn through the second side by removing the needle, bringing the wire across the gap with the two ends projecting on the oral surface.* For the ends we often use horsehair sutures. When all the sutures are passed an incision is made through the mucoperiosteum at the hard palate close to the bone on each side of the front of the cleft and well away from it, the mucoperiosteum is then carefully detached from the bone all round the anterior extremity of the cleft so that the soft parts are quite free and loose. Next, holding all the sutures together in the left hand, the palate knife is carried backwards and outwards from the incision already made until the levator and tensor palati are freely divided and the velum is quite lax. Sometimes it is well to divide the palato-glossus and pharyngeus by snipping through the pillars of the fauces. If there is no tension it is a good plan to make the relaxation incisions after tightening up the suture. A minute or two is then given up to firm pressure with a sponge upon the palate, so that all bleeding may be stopped. Finally, the wires are twisted up—we usually begin with the middle ones, as they bear tension best. The ends are then cut short, the cleft inspected to see that the lips are accurately adjusted, and that there is no tension, and the gag is then removed.

Various modifications of the operation are of course well known, and will be found described in the general textbooks.

During the operation it is important to avoid the use of sponges as long as possible, since sucking out the pharynx much increases the amount of secretion poured out.

The after treatment.—The hands must be carefully secured to avoid injury to the palate, and no solid food should be given for a week. Many surgeons give nothing by mouth at all for forty-eight hours, and feed the patient by enemata. Others allow milk from the first, and soup after two or three days; others, again, allow soft solids from the first; probably it is better to restrict the diet to milk for two or three days and then allow soup and soup till the end of the week; after this the ordinary diet may be gradually resumed, avoiding of course any hard or irritating material. The children are usually taught to take care of themselves, and nothing more is seen

* For knowledge of this most simple plan we are indebted to our colleague, Mr. Hinde.

of them; the child probably spits them out. However, they are setting up irritation, or if after a few weeks they have not come away, they should be removed. Any little granulating point or small perforation left at the anterior extremity of the cleft will usually heal up of itself; if it does not do so the application of nitrate of silver will sometimes succeed, or in other cases a second little operation may be required.

Only one mode of performing the operation of *Unzipping*, or closure of a cleft of the hard palate, will be described here; in our experience it is much more successful than the other plans, and if it fails there is less difficulty in a second operation than after the so-called osteoplastic method.

Operation by *micro-perforated flaps* consists in paring the edges of the cleft throughout, then an incision is made midway between the alveolar margin of the palate and the cleft for its whole length down to the bone. The bridge of micro-periosteum between the incision and the cleft is then stripped off the bone with a No. 11 raspatory completely into the cleft throughout its whole length; this must be done most thoroughly, so that there is no tension upon the flaps, which, however, must not be bruised more than can possibly be helped. The sutures are then passed as in the operation upon the soft palate and twisted up.

In case of operation upon the soft palate alone we prefer the plan of paring the edges first, then passing the sutures, and then dividing the muscles before twisting the sutures; while in *unzipping* the edges are first pared, then the flaps raised, and lastly the sutures are passed and twisted up.

In quite young children it is no advantage, if there is a complete cleft of both hard and soft palates, to close the soft palate alone first and some months after to close the hard; the action of the sphen tends to draw together the sides of the hard palate during growth and makes subsequent closure of the cleft more easy. Operation on a complete cleft of both hard and soft palates should be reserved for older children, who can better bear the increased severity of the more extensive operation. We usually do the whole operation at once.

The *shape of the palate arch*, already alluded to, is of importance; the higher and narrower the arch the easier in most cases is the closure of the cleft, since there is proportionately more tissue to turn across the gap.

In some children the cleft is so wide, that is, the failure of growth of the palate processes is so marked, that it is impossible to close the opening by a plastic operation; in such cases an obturator should be fitted to the gap. Operation is, however, nearly always possible.

In some instances the deficiency may be lessened by operation, even though complete closure is impossible; a smaller obturator is then sufficient.

Obtainers are liable to increase the size of the opening by pressure unless carefully managed.¹

The *results of the operation* are, in successful cases, that the power of swallowing is improved, the food no longer tending to pass into the nasal fossæ, and the tendency to pharyngeal catarrh is lessened. The voice is not improved by the operation itself, but closure of the cleft renders it possible by subsequent training to greatly improve speech; and if sufficient care is

¹ Colet's modification of Simon's is probably the best obturator. *Arch. Dis. Child.* June, November 4, 1906.

congenital condition due to lymphatic overgrowth or enlarged mucous glands (cf. also NANN). When the deformity is sufficiently serious to require treatment, a part of the lip may be removed either by taking out a wedge-shaped piece of the whole thickness of the lip or by splitting the lip and removing a part of its thickness and afterwards stitching together the skin and mucous membrane.

Microstoma, or congenitally small mouth, is occasionally seen, and even complete closure—*stomatocoele*. This is treated by enlarging the opening to the necessary extent, stitching together the mucous and cutaneous borders, and at the corners bringing a flap of mucous membrane across the angle to the skin. Similar operations may be performed in cases of cicatricial contraction after ulceration, burns, &c.

In very rare cases the tongue is congenitally absent.

A common deformity, though not nearly so common as it is popularly supposed to be, is **tongue-tie** or congenital shortness of the frenum. Where this really exists the tip of the tongue is so tied down to the floor of the mouth and inner surface of the jaw that it cannot be protruded, and sucking is materially interfered with: slighter degrees of the deformity often exist, while in rare cases the tongue is so bound down to the floor of the mouth as to be practically immobile (*anchyloglossia*). Tongue-tie is easily recognised by pushing up the lip with the finger in the child's mouth; its treatment consists in snipping through the edge of the frenum with a pair of blunt-pointed scissors and then tracing the rest with the finger nail while the tongue is pushed upwards. The division should be made near the jaw, and should not be too free, or possibly the salivary vessels might be injured, or even, it is said, 'tongue-swallowing' occur, from loosening of the tongue muscles in the child's subsequent efforts at sucking. A more probable danger is the occurrence of cellulitis.

Sometimes the tongue is malformed, cleft in the middle line, or even trilobed,¹ or the muscles of one side may be deficient,² e.g. as sometimes in focal hemiatrophy.

Sublingual cysts may develop in the median line between the geniohyoid glands as a result of persistence of the lingual duct which runs from the foramen cecum towards the isthmus of the thyroid; the cavity of these cysts is lined with epithelium and contains fatty material³ (vide p. 170).

Macroglossia is the term applied to a congenital affection of the tongue in which the normal lymph spaces are greatly enlarged and there is also an overgrowth of the connective tissue of the part; there is, in fact, congenital lymphangiectasis. The result of this is great enlargement of the tongue, which may be kept protruded from the mouth to varying degrees, and by its bulk and tenderness interferes with sucking and breathing. We have also met with slighter degrees of the same condition affecting only the sublingual tissue and resembling varicella. Associated commonly with macroglossia is hygroma or one form of 'hydrocele of the neck.' This is simply a similar condition of the lymphatics of the floor of the mouth and upper part of the neck. It appears as a soft, doughy swelling in the submandibular region, and

¹ *Barling, Brit. Med. Jour.*, December 5, 1886.

² *Chabot in Billard's Mémoires de l'Enfance.*

³ *Ward Norton, Brit. Med. Jour.*, February 27, 1886.

may reach a large size, occupying the greater part of the sides and base of the neck (vide chapter on TUBERCULAR GROWTH).

In severe cases these conditions rarely admit of successful treatment, the children are generally marasmic and often otherwise malformed. Removal of part of the tongue with the écarateur or excision of a wedge from it with subsequent closure of the gap may be attempted. Galvanic puncture, electrolysis, setons, and injections are all worth trying of, and pressure and astringents are said to have done good in some instances. It must be remembered that lymphoma sometimes spontaneously disappears.

Slighter degrees of the deformity are occasionally met with in older patients: in these the condition has a less obvious connection with the lymphatics, and appears to be sometimes mere overgrowth of the mucous and connective tissues.

Ranula is the result of occlusion of a mucous duct and the formation of a retention cyst, rarely it is due to obstruction of a sublingual salivary duct. It appears as a bluish-grey translucent swelling beneath the tongue; it is soft, fluctuating, and painless, but produces deformity from pressure of the tongue upwards and the floor of the mouth downwards, and, if large, interferes with speech and deglutition. The swelling contains a clear glairy fluid like white of egg. Ranula may be treated by excision of a part of the cyst wall or by passage of a seton through it; both methods are frequently successful, but sometimes fail; if they do the greater part of the cyst wall should be clipped away with scissors and the surface remaining be well scraped or rubbed over with solid minute of silver. Relapse is believed to be sometimes due to the cyst being multilocular. Rarer forms of ranula are those due to enlargement of a bursa beneath the mucous membrane (bursa of Fleischmann), or of the one between the geniohyoid-glossal muscles—these may contain melon-seed bodies. Ranula connected with the submaxillary-duct has often been described, but their existence is more than doubtful; the duct can always be made out lying on the surface of the cyst. Congenital dermoid cysts in connection with the branchial clefts are sometimes met with in the floor of the mouth. They may attain a large size or remain stationary for years; they contain the usual sebaceous matter, hair, &c.

A firm cyst arising in connection with the lingual duct which runs from the foramen caecum towards the hyoid bone has already been mentioned. It is due to persistence of the pharyngeal diaphragm from which the thyro-glossal duct is developed, the thyro-glossal sinus. (Vide Median Furca of Neck, p. 170.) The dermoid and bursal cysts are to be treated by fine incision, with scraping and subsequent drainage; in some cases the cyst requires dissecting out through an incision below the jaw.

Other Affections of the Tongue.—**Papilloma** and **cystoma** of the tongue are not rarely seen, as well as naevi and mucous retention cysts. Papilloma may be clipped off, cystoma requires of course specific treatment, mucous cysts should be treated like ranula.

Naevi of the tongue is not rare (vide chapter on NAevi); puncture with the actual cautery is usually the best treatment, but excision of part of the tongue may be required.

Mason has described congenital pendulous fibro-cellular tumours of the tongue.

Hypertrophy and Atrophy of the Face.—In some cases one side of the face is congenitally hypertrophied, and continues to grow more rapidly than the other side. Nothing can be done for this deformity unless, perhaps, ligatures of the external carotid were tried.

Congenital Atrophy, or rather *arrest of development* of the face, is also occasionally seen; most often it is the result of either some cerebral deficiency or of some unilateral lesion, such, for instance, as vertigo; it may occur as an acquired deformity resulting from injury.

Congenital atresia of the mouth has been already mentioned, but in some cases the obstruction is not at the lips, but at the level of the pillars of the fauces, and is clearly due to *non-absorption* of the septum marking off the buccal invagination from the pharynx. If this rare condition is met with, possibly free incision and dilatation would relieve the obstruction.

Actual absence of the mouth with deficient development of the facial bones, and instances of apertures below the normal position or on the cheek, have been met with. (Fisk-Billard, *op. cit.*)

Billard has recorded a case of deformity of the jaws produced by thumb-sucking, the upper jaw being drawn forwards, and the lower depressed so that the face is 'overhanging.'

Branchial Fistulae.—Small orifices large enough to permit the passage of a fine probe for distances varying from a quarter of an inch to two or three inches are sometimes met with in the neck on one side of the middle line. They may occur in the immediate neighbourhood of the external ear or lower down in the neck; the most common position is said to be just above the sterno-clavicular joint. The fine channel continuous with these openings usually runs upwards and towards the middle line. A little watery mucous discharge is often secured from glands lining the interior of the passage, and it is said that occasionally there is a distinct communication with the pharynx. These fistulae, which are often hereditary, may be single, or there may be two or three of them, and they may be symmetrical. Fragments of cartilage¹ may be found in their neighbourhood, and it is possible that pharyngeal diverticula may result from patency of the internal orifices.

The presence of these fistulae is due to imperfect obliteration of the branchial clefts of embryonic life.

While the cervical branchial fistulae are rare, it is quite common to see children in whom there is a small pendulous body, like a molluscum growth, upon the cheek just in front of the external ear. Sometimes there is more than one of these, and very often at the base of the little body is a minute orifice leading a short distance inwards. We have most often seen these '**supernumerary auricles**,' as they are called, unassociated with any other deformity; but in one instance the child, which had several of these auricles, had also macrostomia, double hare lip, and cleft palate, and a small pendulous body exactly like one of the auricles upon the tip of the nose. Our friend Mr. Southam has recorded a somewhat similar case (fig. 27), and Mr. J. H. Morgan another. Cervical 'auricles' are also met with (vide fig. 23).

The cervical branchial fistulae represent the clefts between the hyoid and

¹ *Phil. Soc. Trans.* vol. 55.

² There records a case in which a rod of cartilage entered, but no founda (*Phil. Soc. November 1, 1875*).

thyroid arches, or between the thyroid and subhyoid, or again between the subhyoid arch and the upper boundary of the chest, while the presence of anal fistula occurring, as it sometimes does, in the heels or elsewhere, is due to persistence of one or more of the fistulae between the 'tubercles' of which the pirus is built up,¹ the supernumerary arising themselves representing displaced or inverted 'tubercles.'

The common 'supernumerary' abscesses, which may or may not have a little pit at their base,² are thought by Sir J. Paget to be probably growths of the same opercular skin fold as the abscess from which they look like being detached, or they are abscesses displaced, but still in the line or region of the mandibular arch.³

The abscess, sometimes at least, contains cartilage, and the absorption of encysted matter of the parotid occurring in later life with disturbance of the development of these parts has been pointed out by Mr. Jacobson.⁴

In very rare instances an orifice is met with in the median line of the neck. Of this we have seen four cases, two of our own and two in the practice of our colleagues; in one there was a scar in the skin closely resembling the scar of a traumatic wound, and in the centre of this, just above the sternum, was a small opening; in the second case there was a discharging furuncle over the lower part of the thyroid cartilage. These median apertures may be explained by failure of the branchial arches to close in the middle line, or possibly by a deficient closure of the 'sorus cervicalis.' It is, however, most probable that with a fistula, the 'thyro-glossal duct' or 'canal of His' is, in the words of Dr. C. F. Marshall, who has kindly sent us his paper on the subject, 'a remnant of the middle thyroid rudiment of His. It is not difficult to imagine,' he says, 'that this may gradually become dilated at its lower end into a sac by the secretion of mucus from the wall of the canal, and that this sac ultimately causes the skin to give way by its pressure till a sinus is formed.' Dr. Marshall, in his interesting paper, points out that these fistulae are not present at birth, but appear later, a strong point in support of his view, which is now generally accepted.⁵

As these branchial fistulae give rise to very little inconvenience, it is usually best to leave them alone, especially as they are intractable to treatment from

¹ Vide Mr. Gladstone's Lectures, *Brit. Med. Jour.* February 22, 1897, and Lancet, February 1898, and his book on: *Thymus*, 1899.

² See J. Paget (*Med. Clin. Trans.* 1878), from whose writings much of our information on the subject is taken.

³ Vide Guy's Reports.

⁴ Vide Sir J. Paget, *op. cit.*; also T. Claus and others, *Le Page's Ann.* February 21, 1881; Dr. C. F. Marshall, *Jour. of Anat. and Phys.* vol. xxxv, and *St. Thomas's Hospital Reports*, 1900, and *Brit. Med. Jour.* May 1900.

⁵ Vide Mr. Gladstone's Lectures, *Brit. Med. Jour.* February 22, 1897, and Lancet, February 1898, and his book on: *Thymus*, 1899.

⁶ See J. Paget (*Med. Clin. Trans.* 1878), from whose writings much of our information on the subject is taken.

⁷ Vide Guy's Reports.

⁸ Vide Sir J. Paget, *op. cit.*; also T. Claus and others, *Le Page's Ann.* February 21, 1881; Dr. C. F. Marshall, *Jour. of Anat. and Phys.* vol. xxxv, and *St. Thomas's Hospital Reports*, 1900, and *Brit. Med. Jour.* May 1900.



FIG. 11.—Supernumerary abscess on the neck.

the difficulty of thoroughly destroying their mucous surface. The passage of a hot wire down them, or passing a probe in and then dissecting round it, or the use of the galvano-catheter, is the plan usually advised. In the second of our median fistulae, in which there was a 'pinching' part in the part, we with some trouble succeeded in obliterating it for a time by several applications of nitrate of silver fused upon a wire and passed well up the track; subsequently, however, fresh secretion occurred, and even excision failed to entirely cure the condition; however, complete excision of the whole fistula is the only at all certain method of cure, and this may involve a somewhat troublesome dissection.

Supernumerary muscles should be simply stripped off. They consist of a small rod of yellow elastic cartilage covered with integument, and are supplied with a small artery.

Instead of dimula, congenital dermoid cysts may be found marking the sites of the various fountains &c. of the embryo (vide chapter on TUMOURS GROWTH). Chilton has described a case of congenital papilloma in the line of the branchial fissures; and cases of primary carcinoma in the neck, probably taking origin in relics of the branchial clefts, have been recorded.

In some of these patients the lower jaw is imperfectly developed.

For the best account of the various developmental abnormalities will be found in Ward Swann's interesting 'Tumours, Innocent and Malignant,' Cassell & Co., 1893.

Any part of the digestive tract may be the seat of congenital malformation in addition to those already described. 'Congenital strictures' and 'pouchings' of the oesophagus, tracheal fistulae, displacements of the stomach, obliteration of the pylorus, absence of portions of the intestinal canal, and displacement of its various segments, are all met with, and in certain cases may have some surgical importance; they cannot, however, be discussed here. Enterostomy might possibly be of service in some cases of congenital intestinal deformity where the obstruction was low down (vide p. 140).

¹ Cheswood-Turton mentions some cases in *Zoonosis*. Vide *Fish. Soc. Trans.* 1881.

² Sir Maxwell Mackenzie states that congenital pouching is extremely rare.

³ May be combined with oesophageal deficiency usually at the middle third of the gullet. The anomaly is a persistence of the embryonic condition (See M. Mackenzie).

CHAPTER X.

DISEASES OF THE LIVER.

In examining the liver of an *infant* or young child, it must be borne in mind that this organ is proportionately larger in the child than in the adult; consequently occupies a greater space in the abdominal cavity, and thus to the inexperienced it may appear to be enlarged, when in reality it is only of normal size. The fact pointed out by Sakli must not be forgotten, namely, that the angle made by the lower ribs with the tip of the sternum is wider in childhood than adults, so that more of the liver is left uncovered in the former than in the latter. This may lead to the liver appearing larger than it really is. The upper limit, as determined by percussion (superficial dullness), reaches to the fifth space at the right edge of the sternum, to the upper border of the sixth rib in the nipple line, the seventh in the axillary, and the ninth posteriorly, though the deep dullness reaches somewhat higher. While the edge of the right lobe does not in an adult extend below the costal arch in the recumbent position, as in a child it always does. The size of the liver can be as readily estimated in a child as in an adult by percussion if the stomach is not over-distended; the lower edge can, however, be much more readily felt in a child than in an adult by placing the hands flat on the abdomen and gently pressing backwards and upwards. In most cases it can be still determined if the edge is round or sharp or irregular.

The liver is not often smaller than natural during childhood; it is so only in the rare instances of the occurrence of acute yellow atrophy or cirrhosis, and even in these cases it is by no means always diminished in size: indeed, it is frequently enlarged, a result which is due partly to its vascular nature, its veins being very readily distended, and partly also to the ready way in which it appears to store away fat.

The best instance of its enlargement from mechanical causes is afforded by the congestion which so frequently attends heart disease, where, in consequence of regurgitation through the mitral valves, there is an obstruction to the onward flow of the blood. It is enlarged also in mediastino-pericarditis for a similar reason. There appears also often to be a temporary enlargement and a sluggish circulation in many cases of chronic intestinal catarrh, where there is said to be a functional derangement of the liver, accompanied by loss of appetite and partly constipated stools deficient in bile and an excess of ptycin and perhaps lactic acid in the urine. The liver is frequently enlarged from the presence of excess of fat; more rarely it is amyloid, or the seat of new growths or of abscesses.

Jaundice.—The common form of jaundice occurring in newly born infants has already been discussed; the rarer form in which jaundice is due to lesion of the bile ducts may be here referred to.

Congenital Stricture or Obstruction of the Bile Ducts.—In these rarer cases an obliteration of the common hepatic duct appears to take place, which leads to a secondary or biliary cirrhosis of the liver if the infant survive for a few months. The child may die from hæmorrhage from the navel or gastro-intestinal canal during the first few days of life. Such cases, though not common, are by no means rare. Among the more recently recorded cases are those of Wickham Legg and Glaister; we have seen two cases in which autopsies were made.

Symptoms.—The infant is jaundiced from birth, the yellow colour being intense, affecting the skin, conjunctivæ, mucous membranes, and urine; the stools are pale and completely devoid of bile. The infant frequently suffers from hæmorrhages, the stools then being black and the skin covered with ecchymoses. In one of our cases the motions were stated by the mother to be black immediately after birth. The liver may be enlarged. Such children may live for a few months; both of our cases lived to be 2½ months old. The following case illustrates some of these points:

Congenital Stricture of Hepatic Duct. *William Clerk*, a male H., aged 5 weeks, was brought to the out-patient department on October 2, 1883, with the following history:—Mother states he was an eight-months child, born after a tedious labour. About a week after birth it was noticed he was jaundiced (milklike mucus he was yellow when born); his urine was dark and stained the linen; the stools were loose and pale grey in colour; he did not 'muffle,' and there never was any rash. On examination, when 4 weeks old, he was deeply jaundiced, body well nourished, the edge of the liver was felt immediately below the ribs. October 8.—Much the same; diarrhoea troublesome, pale whitish stools. October 21.—The liver is enlarged, the edge being felt nearly on a level with the umbilicus; it has been increasing in size the past week or two. November 1.—Liver still enlarged; stools loose, resembling milk; still intensely jaundiced; it becomes very thin. December 6.—Liver decidedly less; diarrhoea not so troublesome; continues to waste. December 20.—Diarrhoea has been very troublesome; convulsions, death when 2 months old. He had not at any time suffered from purpura or hæmorrhages.

Post-mortem.—Body extremely emaciated and deeply jaundiced; all internal tissues discoloured. Heart, muscular walls pale yellow; lobes dark. Liver, 2 in.; does not appear enlarged; is of a dirty dark green colour, surface finely granular; no adhesions to peritoneum or coating of paps in the fœtus; it has a tough feel, and cracks under the knife as it is cut; the surface shows a dark green colour with islands of brown tissue, much in form of the normal state accompanying the portal veins; the strands are best marked near the entrance of the vessels at the hilum, and the larger bile channels are more or less dilated and contain thick green bile. On exposing the inferior surface of the liver, the gall bladder is seen attached with a scissel-like round duct; its duct can be traced downwards, though smaller than normal, to the ductus cholecysticus; the latter joining the duodenum in the normal position is present and contains mucus only. No trace of a right or left hepatic duct can be found. The portal vein and hepatic artery are apparently quite normal. Microscopical examination of liver shows extent of fibrous tissue surrounding portal vessels and lobules; many small biliary ducts are seen choked with impunctated bile.

Diagnosis.—The obstructive jaundice of the newly born can be readily distinguished from functional jaundice; the only form likely to be confounded with it, by the stools in the former being colourless while the latter contain bile.

Merbid Anatomy.—There is much maceration, the internal organs are intensely bile-stained, with minute haemorrhages on their surfaces. The liver is mostly enlarged and of a dirty green colour; the surface is granular, the granulations varying in size from a millet seed to a hemp seed; it has a tough feel, and on section an excess of fibrous strands is seen accompanying the portal vessels—this is most marked at the great fissure; the larger biliary channels contain green inspissated bile. On examining the vessels in the transverse fissure, the vein and artery are intact, but the gall bladder is usually small and contains no bile, and the common and hepatic ducts are either shrivelled up and nearly obliterated or greatly diminished in size. Microscopical examination of such livers shows biliary cirrhosis. The etiology of these cases is obscure; in some cases apparently the ducts are never formed. In one of our cases the mother had suffered from syphilis, but neither of the infants showed any symptoms. It is possible that a catarrh of the bile ducts occurring during foetal life or a blockage from inspissated bile might lead to a permanent obstruction and obliteration. The cirrhosis follows as a result.

Prognosis.—Such cases are necessarily fatal in a few months, and hardly admit of any treatment.

Catarrhal Jaundice

Children of all ages are apt to suffer from a temporary jaundice, associated with gastro-intestinal catarrh, attributable to a swollen condition of the mucous membrane of the duodenum and common bile duct.

Symptoms.—After a few days, in which there are symptoms of dyspepsia, the conjunctivae and skin become yellow, the urine contains much pigment, and the stools are pale. A few days later the liver may be felt to be enlarged. There are rarely the nausea, low temperature, and slow pulse so often seen in the catarrhal jaundice of adults. We have, however, seen one or two cases in which there were jaundice, delirium, drowsiness, and slight fever, in which we suspected acute yellow atrophy, yet they finally recovered, and we were left in doubt as to their nature. As a rule, in the course of a few days or a week all the symptoms disappear.

The diagnosis of catarrhal jaundice does not usually give rise to difficulty when it occurs in children. The possibility of the jaundice being due to acute yellow atrophy must be borne in mind, and any ecchymoses or brain symptoms would be very suggestive of the latter. Jaundice due to cirrhosis, or new growth, or syphilitic disease, could hardly be mistaken, as jaundice under these circumstances would not be an early symptom. It is possible that jaundice may be due to round worms finding their way into the duodenum, and entering the common duct.

Treatment.—The treatment of catarrh of the bile ducts should be similar to that of gastric catarrh: the diet consisting of beef tea, bread soup, light puddings, and milk. Sulphate or phosphate of soda may be given with infusion of rhubarb two or three times a day. Carlsbad salts or Friedrichshill water is useful in keeping the bowels open.

Acute Yellow Atrophy of the Liver

This curious and interesting disease appears to occur at all periods of life, infancy and childhood not excepted. Several Continental writers have

described cases occurring in infants a few days old, but whether these were in reality true cases of yellow atrophy may be open to doubt. Undoubtedly, infants who are jaundiced shortly after birth die in the course of a few days or weeks with symptoms of acute disease, but, as far as can be judged from the reports, the naked-eye appearances of the liver after death were not those usually found in acute yellow atrophy. In such obscure diseases as those named after Ruhl and Winkel, jaundice occurs. While this disease cannot be said to be common at any time of life, it is perhaps rarer in childhood than in early adult or middle life, though it is very probable that cases are not infrequently overlooked, inasmuch as some of the recorded cases were not diagnosed during life. That they are not rare is certain, as Dr. Hyla Greves has collected seventeen cases besides one observed by himself. We have seen two cases, one of which occurred in a boy of 4 years, and we have had the opportunity of examining the liver in a case of Dr. Barlow's.

Symptoms.—The disease begins insidiously; the first symptoms are chiefly those of catarrhal jaundice, loss of appetite, constipation, and jaundice, the stools are mostly pale but sometimes quite normal, and the urine is bile-stained. The patient usually remains in this condition for a week or two, during which time neither his friends nor medical attendant suspect the serious nature of the disease. The liver at this period is enlarged and in some cases distinctly tender. Then come distinct cerebral symptoms which may not unreasonably be mistaken for the onset of tubercular meningitis. The child is irritable, vomits repeatedly, rambles at night, is perhaps very delirious or comatose; the pupils are generally dilated. There are often ecchymoses about the body at the seat of slight injuries, and oozing of blood from the gums and orifices of the feet and face. After a few days the child passes into a condition of coma; there are also probably muscular twitchings, spasms of several groups of muscles, as the masseters, and perhaps local paralysis. The urine may contain leucin and tyrosin. In the later stages the liver diminishes in size, but this is not invariably the case. The following case illustrates some of these points:

Acute Yellow Atrophy of Liver.—Stephen T., aged 4 years. Admitted September 27, 1884. Mother dead. No history of congenital syphilis could be obtained. Father is a laborer in poor circumstances. Child has been much neglected and often had insufficient food. Four weeks before admission child took very little nourishment; became yellow and emaciated. Constant diarrhea coming later; and lately he had been delirious at night and quiet in the day. Present state.—Patient is a well-developed boy; indistinctly jaundiced; there is oedema of both eyelids, back of hands, and dorsum of both feet. He is frequently vomiting, is listless, and does not readily understand what is said to him. His tongue is red at the tip and edges and coated in the center; he is very thirsty, but almost constantly vomits his milk immediately after it is taken. Abdomen somewhat distended; edge of liver distinctly felt below costal arch and in epigastrium, and on pressure dullness extends upwards to the fourth space. The tip of the spleen is felt below the umbilicus. Heart's sound normal; no marked physical sign is found. Urine passed with force or in bed; urine separated from stool contained bile pigment; no albumen; no leucin or tyrosin under microscope. Feces, passed a few hours after admission, were solid and of a dark green color. Pupils dilated, but not to light. Pulse, 100, weak, irregular. 90° F. Second day (of admission).—Vomiting continued most of day, but not after noon; with sick green. Temperature, 104° rect. Third day.—Less vomiting; bowstrings from mouth, severely inflamed; bowels acted once after

colored, solid brown surface; no urine passed in twenty-four hours. Temperature, 98° 1/2°; 98° 1/2°-100° F. Fourth day.—Child has been delirious, with some incoherent speech of face and neck. This morning, left facial paralysis noticed not affecting the eye; it is well marked when child cries, but not complete; no paralysis elsewhere; much dilated and sluggish; child only semi-conscious; several loose stools passed after sunset, the first light yellow, later pale grey colour; no urine obtained; edge of liver very distinctly felt below umbilicus. Pulse, 120, weak; temperature, 100° F., 101° 1/2°; 100° 1/2° and 101°. Fifth day.—Much worse; is quite unconscious; head and eyes turned to right; all limbs extended and rigid; spasms of slow running convulsions, grinding of teeth; bounding stercorous; no urine passed, but veins are full and somewhat tortuous. Pulse, 120, weak; temperature, 101° 1/2° and 102°. Died in afternoon.

Post-mortem (twenty-two hours after death).—Nails soft and short; skin very yellow; much hyperæmia throughout of dependent parts of the back and arms and legs; some grosser hæmorrhagic ecchymosis from mouth; no rigor mortis; slight icterus; a brown area on a penny in size on the subcutaneous region, left side. Chest: no fluid, all effusing left side. Right lung in section showing numerous small hæmorrhages into substance of lung; lower lobe are pigged. Left lung: there is a solid portion in upper lobe, extending anterior surface and corresponding in a position with above-mentioned lesion, involving the whole thickness of the lobe, but not the more or more edges. The solid, grey solid portion consists of red decomposition with a blood clot in centre and a circumference; lower lobe pigged and containing small hæmorrhages. Bronchi contain blood and mucus. Heart, 2 1/2 in. Left side contracted, containing a few strings of white fibrin; walls of heart pale yellow and fatty; no endocarditis; hæmorrhages into muscle of ventr. Atheroma: no opening, a few centers of fibrinous fluid clumped. Main infarct of small vessels of secondary in the neighbourhood of the liver, one hæmorrhage, one of white, a secondary of dissolving clot. Stomach contained coffee grounds; mucous coat darkish contents; rest of wall and large intestine contained pale yellow semisolid contents. Spleen, 1 in., firm; somewhat enlarged but normal. Kidney, 4 1/2 in., cortex pale yellow, and has a glazing appearance from pressure of fat; pyramids congested. Uterus: nothing normal at base, but convolutions on upper surface are decidedly flattened; the convolutions are flattened with thick fluid, and the parts around, especially the white portions, are softened and easily with away under a stream of water; no loss of form or softening noted elsewhere; no hæmorrhages. Liver, 14 1/2 in. It is very large, and capsule stretched on distending up. Right lobe: upper and lower surfaces are irregular from pressure of some portions which are more elevated than others; the more elevated portions are greenish yellow, and the others red. The lower, light orange-yellow and red portions are seen; the lobules are not readily seen in the upper parts, which are soft. In the red, which are firmer, the lobules can be distinguished, the center being bright red and the circumference pale. The left lobe contains most of the red parts and the right more yellow. Macroscopical examination.—Red portions, the trabecular veins are normal, the walls of the trabeculae most contain numerous leucocytes, and the surrounding connective tissue is also infiltrated; the lobules consist of layers of cells, but *Eryngium* album, leucocytes, many red corpuscles. The biliary capillaries are very prominent objects, and seem to contain mucus with some underlying inflammation. Yellow portion.—The lobules are large; central vein distinct; hepatic cells normal; nuclei obscured; few granular contents and little pigment. The walls of interlobular veins infiltrated with leucocytes. Biliary capillaries filled with epithelium.

Diagnosis.—Malignant jaundice in an early stage cannot be distinguished from catarrhal jaundice; it is only when cerebral symptoms appear, and there are dilated pupils, ecchymoses, or constant vomiting, that the suspicion is raised that there is something more than simple jaundice. At this time the case is liable to be mistaken for meningitis, though the presence of jaundice and cerebral symptoms should indicate the true nature of the disease. It may possibly be confounded with pyæmia, phæmæmia poisoning, or pœ-

meia with jaundice, but in all these the jaundice would as a rule follow and not precede the other symptoms.

Mortal Anatomy.—Organs life-stained; hemorrhages in various organs. Liver small, firm in texture, mostly bile-stained, some portions being greenish yellow, others orange-red, often bulging in some parts from shrinking in others. On section, there are usually areas of red or yellow color in which the lobules are indistinct or entirely indistinguishable.

Treatment.—Unfortunately but little can be said under this head, as such cases have been invariably fatal.

Cirrhosis of Liver

Alcoholic.—A typical habitual liver due to alcoholism is necessarily rare during early life, as it is hardly likely that it will often happen that a child has many opportunities for indulging in alcoholic drinks to any extent. Cases of this sort have, however, been reported by Continental writers, and a few in this country and also in America. Dr. Wilks relates the case of a girl of 8 years who had taken daily for some time half a pint of gin; she eventually suffered from ascites, and at the *post-mortem* a small habitual liver was found. Cases of cirrhosis have been reported by French, Barabergers, Howard, and others, in which there was a history of alcoholism. Mitchell Clarke¹ reports two cases of cirrhosis of the liver in children, in which there was no history of syphilis, tubercle, or alcoholism. As the symptoms of alcoholic cirrhosis when it occurs in childhood are the same in children as in adults, no special description is needed here.

Syphilitic Cirrhosis.—Syphilis is by far the commonest cause of interstitial hepatitis occurring during early life; though in a large proportion of cases it is found in the *post-mortem* room in cases in which it was not diagnosed during life. In syphilitic infants who are born dead, or who die within a few months of birth, the liver is sometimes found to be enlarged and firmer than usual, the surface is perhaps smooth, but the liver cuts as if of leathery consistence, and the cut surface shows the acini to be less distinct than normal, and bands of fibred tissue may be seen running through the liver substance. In some cases there are no very characteristic microscopic appearances, and it is only on microscopical examination that interstitial hepatitis is made out. In a well-marked case the section shows an excessive amount of connective tissue along the course of the portal vessels, and numerous spindle cells and embryonic tissue. In more advanced cases islands of fatty liver cells may be seen surrounded by newly formed connective tissue. The above appearances are so characteristic of congenital syphilis, that they are diagnostic of syphilis when found *post-mortem*, even in the absence of symptoms during life and other confirmatory evidence after death. Gubler has described another form of syphilitic liver, in which there are milky granules present in the liver mostly about the size of pin's heads, scattered through the substance or situated in groups, in combination with interstitial hepatitis. The small granules consist of small round cells, and are mostly connected with the smaller branches of the portal vein or biliary capillaries (Dorsch Hirschfeld). There is often also thickening

¹ *Brit. Med. Jour.*, June 30, 1906.

and thrombosis of the small vessels, the changes being similar to the arteries found in syphilitic disease of the brain. In older children cheesy nodules and circumferential bands of fibroid tissue are found on the surface of the liver, similar to those found in syphilitic disease of adults. There may be fibroid bands and cicatricial tissue in the great fissure and accompanying the portal vessels into the liver substance. In some cases there is a post-hepatitis as well as an interstitial hepatitis.

Symptoms.—In infants almost the only symptom is an enlarged liver, having perhaps a harder feel than normal, and in some cases more or less jaundice. In older children the liver may perhaps be felt to be enlarged and the edge irregular; there will perhaps be other symptoms present that point to syphilis; in a few cases there has been ascites from portal obstruction. Such cases have been described by Cheslle, Norman Moore, and Lewis Smith, of New York.

Diagnosis.—The diagnosis of either alcoholic or syphilitic cirrhosis would be greatly assisted by a history of alcoholism or of syphilis, or in the latter case by other evidence of syphilis afforded by the patient. In older children, the presence of pegged teeth, interstitial keratitis, or scars about the mouth would naturally suggest that the enlarged liver present was syphilitic. In the absence of other evidence of syphilis in cases of ascites with enlarged liver, it is rarely safe to diagnose a syphilitic hepatitis, as both ascites from chronic peritonitis and portal obstruction from mediastinitis are intercommunion than syphilitic cirrhosis. In portal obstruction the spleen is mostly enlarged.

Treatment.—Not much can be expected of anti-syphilitic remedies in syphilitic cirrhosis, as it is hardly likely fibroid tissue can be absorbed. Still it will be wise to give mercury and iodide of potassium by the mouth and apply mercurials locally. The ascites may be relieved by tapping.

Miliary tuberculosis, malaria, chronic peritonitis, chronic heart disease, and mediastinitis, may all give rise to interstitial hepatitis in a minor degree. In cases of mediastinitis where there has been some obstruction to the flow from the hepatic veins, the liver becomes often enormously enlarged and sponge-like from the dilatation of the capillaries and small vessels, and there is an excess of fibroid tissue formed.

Treatment.—The treatment of portal obstruction, the result of a cirrhotic liver, is only palliative, for there is but little reason to hope that even in syphilitic disease there is much chance of modifying in any way the fibrous tissue which is strangulating the portal channels in the liver. Relief must be sought by unloading the portal system by purgatives and diuretics and by removing the ascitic fluid by tapping; the latter is best performed by means of Soubeir's trochar. In syphilitic cases the local injection of mercurial ointment and other specific treatment should be tried.

Fatty Liver

The liver becomes enlarged from being infiltrated with fat in several different diseases during infancy and early childhood. It is common to find children who are fat, pale, andrickety, with large livers, the edge of the right lobe reaching nearly into the iliac fossa and the left to the umbilicus. If an opportunity occurs for a *post-mortem* examination, such livers are found

to be pale and greasy, the lobules being indistinct, and the cells are microscopically to be loaded with fat. Such children are usually anæmic, have large distended abdomens, coated tongues, pasty stools, and suffer from chronic indigestion. Under a careful dietary, small doses of mercurials and salines, such as Carlsbad or Rubinat water, improvement gradually takes place and the liver diminishes in size.

Tuberculosis of the Liver

Although it is exceedingly common to find tubercles in the liver in children dying of general tuberculosis, it is exceedingly rare for these tubercles to have given any indication of their presence during life. Tubercular disease of the liver generally takes the form either of grey milky tubercles scattered through the organ and on the surface, or of cheesy nodules, rarely larger than peas or at the most small marbles, which appear to have a special predilection for the neighbourhood of the bile ducts. These caseous masses may be found hile stained on section, and small cysts formed of dilated bile ducts filled with inspissated bile may be found which have been caused by compression of the ducts. Jaundice is rarely produced unless there are enlarged caseous glands in the transverse fissure compressing the common duct. In very rare instances caseous masses appear to form in the liver, resembling the caseous masses even in the brain: these may cause enlargement of the liver and gradually soften down into a chronic abscess. We have seen only one case of this kind. The history was as follows:

Case of Tuberculosis. Malignant Disease.—Boy, aged 14 years, father and mother dead; never been out of England; admitted December 21, 1886; recently had pain in right side and cough; an anæmic boy; yellowish macular rash; pain and tenderness about hepatic region; dulness in right supra iliac to fifth rib, and two inches below ribs. Temperature, 99°-101°. January 23.—Slight albumen in urine; liver is larger, is tender to the touch and on percussion; fine rales at base of right lung. Temperature, 99°-101°. 26th.—Liver excessively tender, hepatic region bulging; left lobe halfway to umbilicus; dulness at base of right lung to angle of scapula; explored left lobe of liver with syringe, only obtained blood; albumen in urine; is wasted. 28th.—Fluctuation felt in liver; aspiration—this gave obtained six ounces or two of thick pus. 26.—Fluctuation distinctly felt; aspirated intrapleurally, 4 oz. of thick glairy pus mixed with blood and bile; tube inserted, followed during evening by large discharge of pus. 28th.—Has been very weak, vomiting; left leg very anæmic for a day or two, now dark blue as if becoming gangrenous; rashes death.

Post-mortem.—Body emaciated; put swelling up from femoral opening; left leg much swollen; some fluid in pericardium. Heart normal. Right lung adherent to diaphragm by lymph and fibrous tissue; no pneumonia; the diaphragm abnormally raised by the enlarged liver below, and is adherent to it by brown lymph; the liver has been punctured in the left lobe near its junction with the right in its upper and anterior surface. The fœdular opening creates a very irregular cavity containing pus; this cavity contains semi-solid cheesy material and irregular fibrous trabeculae, which give it a spongy appearance; posteriorly in the right lobe is a cheesy mass, size of an orange, beginning to become watery, and containing a little pus; a few other irregular masses joining together; no nodaceous change. Spleen enlarged, lardaceous. Lymphatics matted together by old adhesions, the structure containing crumpled masses hard peritoneum from suppurating glands; contains numerous old tubercular alveoli; no brown necrosis. Mesenteric glands in places oedematous. Left internal iliac vein, anti-venous clot; kidneys compressed, not lardaceous; lungs, old scars at apices; pulmonary artery remains pale swollen clot; embolism.

Hepatic Abscess

Children occasionally suffer from multiple abscesses, the result of the absorption of some septic material from the region of the portal vein, or from some abscess in the immediate neighbourhood. Thus in one case under our care multiple abscesses in the liver were evidently secondary to an ulcer in the nasal appendix caused by a pin which had been swallowed. In a second case there was a large hepatic abscess communicating through the diaphragm with an empyema in the right pleural cavity; and in a case of Dr. Hutton's hepatic abscesses were due to the contiguity of the liver with suppurating retro-peritoneal glands. In some cases which have been recorded abscesses in the liver were secondary to typhoid ulcers, and in others to the irritation of worms which had penetrated into the bile ducts. The symptoms consist in enlargement of the liver, extreme tenderness, and intermittent fever. The prognosis is bad. If pus is found, it should be evacuated antiseptically.

Hydatids

Hydatid cysts in the liver are not uncommon during later childhood, but are decidedly rare before five or six years of age. If the cyst is of any size and situated in either lobe so as to come in contact with the abdominal wall, it will form a smooth, rounded swelling continuous with the liver, neither painful nor tender, elastic to the touch, or actually fluctuating. Diagnosis under such circumstances is easy, especially if the tumour is tapped or aspirated, the fluid withdrawn being of low specific gravity, non-albuminous, and containing some of the scolices or pieces of cyst wall. If the cyst occupy the posterior part of the right lobe, it may push the diaphragm upwards and discharge into the lung or pleural cavity; occasionally the cyst suppurates—in this case there are hectic fever, pain, and the symptoms of an abscess.

Treatment.—Aspiration of the contents of the cyst may be sufficient: the latter collapses and the hydatid is destroyed. The operation may have to be repeated, as the cyst may fill up with serum. If suppuration or an incision is required, and in many cases it is better to open the abdomen, secure the cyst to the abdominal wall, and drain the cavity without any previous aspiration, even if suppuration has not taken place.

Tumours of the Liver

New growths originating in the liver during childhood are among the greatest rarities, though cases of carcinoma, sarcoma, adenoma, and cavernous tumours have been described. An interesting case of lymphadenoma of the liver, the only one which we have met with, was admitted to the Children's Hospital, under Dr. Humphreys (now of Torquay), in 1875.

A boy aged 14 years suffered, for a month before coming under notice, with pain in the right hypochondriac region and swelling; he noticed a swelling in the same region about two weeks before admission. When first observed he was pale and sallow, but not jaundiced, the liver was enlarged, the edge reaching nearly to the umbilicus; there was large bossy swelling situated between the right costal arch and the umbilicus. His abdominal veins were enlarged and tortuous. Aspiration of the tumour yielded

making her blood. He wasted, there was a hectic temperature 102°-100°), and the peritoneum and right pleura became distended with fluid. He died seven weeks after admission, having had symptoms for three months. At the post-mortem the abdomen was contained much fluid, the right lobe of the liver was much enlarged and contained a hemispherical mass, which on section had the appearance and consistency of brain tissue; there were some hemorrhages into its substance, and flexural bands passed through it. It was surrounded by a broad zone of compressed liver tissue. There was a mass of enlarged glands in the fovea. The right pleura was full of fluid. Microscopically the new growth resembled the structure of lymphatic glands. In this case it was not easy to decide where the growth commenced, but, as in the analogous case of lymphadenoma of the kidney, there is a strong probability that it began in the lymph glands of the liver and grew into and compressed the liver substance.

CHAPTER XI

DISEASES OF THE RESPIRATORY APPARATUS

The Thorax in Infancy and Childhood.—It is necessary when examining the chest of an infant or child for the first time to have it completely bare, so that a thorough examination can be made, the infant lying in or on its mother's lap; care must, of course, be taken to have the room sufficiently warm, as infants readily take cold when a large surface of the skin is exposed, and they are very sensitive to draughts.

The way in which the child breathes should be carefully noticed. There may be a 'crowing' inspiration as in laryngismus, or it may be stridulous, there being an evident obstruction both to filling and also emptying the chest. The cough may have a metallic or clanging ring.

On inspection it will be noticed, *firstly*, that an infant's chest is deeper than an adult's, i.e. in other words, the antero-posterior diameter more nearly approaches the transverse, the ratio being 1·2 in an infant, 1·2½ during childhood, and 1·3 or 3½ in adults; the horizontal section is thus more circular in form during infancy than in later life. *Secondly*, the angle which the costal cartilages make with the sternum is larger in children than in adults, that is, the lower part of the thoracic cage is widened out more; this may be in part due to its accommodation by the abdominal viscera occupying a relatively larger space and pressing the diaphragm upwards. This is seen in an exaggerated form in children who have enlarged livers and constant gaseous distension of the stomach and intestines. Any acquired deformity should be carefully noted; various rickety deformities may be present—one side of the chest may be contracted from an old pleurisy or empyema, or the left chest may be dragged downwards by an hypertrophied heart or distended pericardium.

The position of the cardiac impulse should be determined. Note must also be made of the frequency and character of the respiratory movements, whether deep or shallow, whether one side moves more freely than the other, or there is any sinking in of the epigastrium or intercostal spaces and ribs during inspiration. It should be borne in mind that mere frequency of respirations does not necessarily mean any respiratory disease, but may be due to rapidity of the heart's action accompanying high fever or cardiac feebleness. Note also if there is any paralysis of the diaphragm or intercostals.

After inspection it is usual to *percuss* the chest, placing one finger of the left hand against the chest wall and striking it with more or less force with the middle finger or forefinger of the right hand, taking care that the child lies or sits up straight, for if the body be relaxed, so that one side

belges on more than the other, a fallacious hyper or impaired resonance may be produced. All the regions of the chest must be carefully examined in turn. Too much stress should not be laid on a slightly impaired resonance, especially if the child is crying, unless the result of auscultation corresponds, and a subsequent examination confirms the result. A typical 'cracked-pot' sound is readily elicited in an infant on account of the yielding nature of the chest walls quite apart from the presence of cavity or any lung lesion: Careful note must be made of any spot where there is dullness or impaired resonance or hyper-resonance denoting emphysema, but bearing in mind that at times a 'booy' note is elicited over lung in an early stage of pneumonia or acute congestion. It must not be forgotten in examining the chest that the diaphragm usually takes a higher position in children than in adults, especially when the stomach and intestines are distended with gas.

In auscultation the ear may be placed directly against the chest wall, or (what is much more convenient) a binaural stethoscope with a small chest piece may be used. All parts of the chest should be carefully examined, noting the character of the breathing, whether the air is entering every part of the lungs equally, or whether the air is not entering one part freely while other parts are being overworked. Weak breathing may be due to an early stage of pneumonia, effusion of fluid, collapse of lung, compression of a bronchus, or a pneumothorax.

'Puerile' or harsh breathing is due to a portion of lung being overworked; it is never safe to accept it as a sign of a lesion in the lung, as at first a student is inclined to do, and, moreover, the breath sounds may appear loud and harsh to an ear accustomed only to adults. It is not uncommon in young children to note on one occasion that the breathing is weak or almost absent at one base and loud elsewhere, whereas after a fit of crying, or the next day, the weak breathing has completely disappeared; in these cases a bronchus with its branches has been temporarily plugged with mucus, which has become displaced by coughing. Bronchial breathing is present in consolidation of the lung from pneumonia or tubercular infiltration, but it is also present in the majority of cases in effusion of fluid, though in this case it is usually weak and distant instead of being intense and blowing. Cavernous or amphoric breathing is not often heard, as cavities of any size are rare in young children. Among the adventitious sounds, fine crepitation is rarely heard in the early stages of pneumonia, the rales being mostly of medium size; they may be 'coarse' or 'ringing' in character when conveyed to the ear through solid lung, or subcrepant and ill defined when the secretion is thick and they have to pass through normal lung to reach the ear. Vocal resonance, or fremitus, often gives no definite result in girls or young children, though when the child is crying violently the increased resonance of the voice heard over a base or apex may be of diagnostic importance. It is needless to add that the physical examination of young children is often beset with difficulties on account of their restlessness or fright, and the examiner may have his patience often sorely tried, and perhaps may fail to obtain a satisfactory examination from this cause.

Infantile Respiratory Spasm, Congenital Laryngeal Stridor.—It is not uncommon to meet with infants a few weeks old, who from their birth have made a peculiar stridulous sound, more especially during inspiration.

In most cases this state of things lasts for some months, perhaps getting worse, and it gradually disappears, so that before the middle of the second year it has entirely disappeared. It is not dangerous to life, as is true laryngismus. This condition has been noted by several writers, including Drs. Gee and D. B. Lues, but the fullest and most accurate account has been given by Dr. J. Thompson (*Edin. Med. Journal*). The last writer has carefully studied five cases, and made laryngeal examinations as far as it was possible, but it is rare to be able to get a good view of an infant's vocal cords. He describes the stridor as follows: 'Inspiration begins with a creaking noise and ends in a high-pitched caw, which two of the authors described as being just like a hen.' In some cases there is an indrawing of the chest wall during inspiration and a tendency to pigeon breast. The laryngeal examinations made by Drs. Thompson and McIndoe showed the epiglottis as far as seen to be normal, though in one case there was a chronic pharyngitis. It is clear in most cases the stridulous noise is produced by a spasm of the muscles of the larynx, and is apt to be worse when the infant is excited, in this respect resembling laryngismus. The etiology is by no means clear. It does not seem to be affected by drugs.

In some few cases we have noted, in addition to a certain amount of noisy respiration in infants, there is a tendency to choke when drinking, some of the fluid entering the larynx by accident. This condition, though alarming to the friends, does not appear to be dangerous, and gradually improves as the infant grows older. In all these cases it is wise to examine carefully for post-natal syphilis.

Laryngismus. Spasm of the Glottis. 'Child Crowing'

The term laryngismus is applied to a peculiar form of laryngo-respiratory spasm which occurs almost exclusively in rickety infants. In laryngismus there is no lesion of the larynx, or only in a small minority of cases is there a laryngeal catarrh; it is usually a pure spasm, and it is only for the sake of contrasting it with other forms of laryngeal troubles that it is placed in this section rather than among the obstructive disorders, to which it more properly belongs.

In by far the majority of cases the symptoms of rickets are present, but we must not in all the cases expect to find marked enlargement of the epiphyses, especially in infants of a few months old. Sometimes rano-tubes may be detected; usually there is some beading of the ribs and recession of the chest walls during inspiration.

The characteristic feature of the attack is a sudden 'holding of the breath' for a few seconds; then the glottis is burst open, the air rushing in with a stridulous sound or in a series of short 'chicks,' but in many cases there is no abnormal sound, the attack consisting entirely of holding the breath. The attack closely resembles, only in an exaggerated form, the 'catch in the breath' which takes place as a preliminary to a good deal of crying, or, as Gay points out, of rage or bad temper. The condition seems to be as if the expiratory respiratory centre discharges for a few seconds an excessive quantity of nerve force, producing a spasm of the glottis and of the muscles of expiration, while the more powerful inspiratory centre, as it is soon

and more stimulated by the increasing velocity of the blood, strives, as it were, for mastery, and at length, when it succeeds, the glottis is burst open, and air rushes in through the narrow chink. In a severe attack, not only is the glottis closed by the adductors of the cords, but the epiglottis may be felt by the finger to be spasmodically applied to the superior aperture of the larynx, and the respiratory muscles are in a state of spasm.

Seaton and Horsley have shown that the expiratory respiration centre is situated in the monkey in the cortex, 'just posterior to the lower end of the precentral sulcus at the base of the third frontal convolution.' Stimulation of this region produces adduction of the vocal cords, and if the excitation be powerful enough, spasm of the muscles of the face, neck, and upper limbs. The same observers failed to discover any inspiratory cortex centre, but found that excitation of the accessory sulcus in the medulla oblongata evoked abduction of the cords. In rickets the nerve centres are in an unstable condition, and liable to liberate nerve force on the slightest provocation. In some cases many of the cortex centres discharge, and a general convulsion is produced; in other cases it may be, at first at any rate, the expiratory respiration centre only, and a spasm of the glottis is produced.

The exciting causes are probably many. The commonest is some emotional disturbance: a fit of crying or of anger may quickly pass into an attack; fright or a sudden start may bring one on. The act of swallowing seems also sometimes to give rise to an attack. Dentition, irritation of the mucous membrane of the pharynx and larynx, nasal adenoids, constipation, may perhaps act as exciting causes. In an infant we saw, with Dr. Lawton, of Eccles, the attacks were apparently worse during the time it was suffering from some aphthous ulcers on the soft palate. We have also seen cases which were worse during an attack of bronchial catarrh. We are not inclined to attach much importance to an enlarged thymus, swollen bronchial glands or cruet-tubes as exciting causes.

Symptoms.—In the milder cases, which are the most common, the child's inspiratory movements are accompanied by a slight 'crowing sound,' which does not appear to distress it, and which passes off during sleep. Sometimes the crowing will last for days, and pass off again for some time. In some few cases the stridor is present during sleep as well as during the time the child is awake. In the most severe cases the attacks come on at frequent intervals, and are distressing in the extreme; without warning, the infant is seen to stretch up its face as if for a crying fit, it holds its breath, no air enters, and the respiratory muscles are rigid and motionless, the veins on the face and scalp become distended with venous blood, the face and lips become blue, or of a dusky tint; then after ten or more seconds the obstruction to the air entering the lungs is overcome, and air rushes into the now open glottis. In some cases we have noted that while at first the respiratory muscles are quite motionless, in others, after the obstruction has lasted some seconds, the diaphragm begins to work spasmodically, and will often succeed in forcing the glottis, so that for a few seconds air is admitted at short intervals into the chest; then for a time the attack is over, but may be shortly followed by another.

These seizures, especially the more severe ones, are accompanied by clonic spasm of the limbs; sometimes we have even in these attacks the

infant throw his hands up like a drowning man, and then, after the laryngeal spasm is over, the nerve discharge passes into the limbs, and the limbs become set, as in tetany, with the thumbs turned in, and the feet in a position of equino-varus.

These attacks may come on at all times of the day or night, and on very slight provocation. We have already referred to the most common exciting causes; the most important, perhaps, is some emotional disturbance. One of these seizures, as we have already pointed out, is very much like what takes place in the early stages of a fit of crying; the facial muscles are contracted, the mouth is open, the breath is held, the air enters the chest spasmodically by the contraction of the diaphragm. Herbert Spencer remarks that as 'overflow of nerve force, undirected by any motive, will manifestly take the most habitual routes; and if these do not suffice, will next overflow into the less habitual ones.' We can easily understand on this principle that a discharge of nerve force from unstable nervous centres may take the routes which in infants produces a good cry, and may overflow into the muscles of the extremities, producing a spasmodic condition, i.e. 'tetany.'

One point we must not forget to emphasise, and that is, that many of the most severe attacks are not accompanied, or rather followed by a definite crowing sound. It is really the less severe ones in which the crowing inspiration is best marked; the danger necessarily depends more upon the length of time during which the breath is forcibly held, than upon the manner in which the air again enters. In many of the worst cases it is admitted spasmodically in sobs, and not in a long-drawn-crow.

Children who suffer from laryngismus are not only tickety, but are nearly always dyspeptic. There is often a difficulty in digesting cow's milk, the stools contain much undigested curd, and there is chronic distension of the bowels. They are not infrequently well nourished, as far as fat goes, but their muscles are poorly developed. It is unnecessary to say that it is artificially fed infants who are the chief sufferers from laryngismus. The following case illustrates some of the points we have referred to:

Laryngismus. History.—S. H., aged 18 months; attacked February 20. Mother says he has never been strong; has had a 'croupy cough' since 14 days old. For the last five weeks has had noisy choking fits, sometimes as many as twenty in one day. Weight 5 lb. 14 oz. He is small for his age and cannot sit up; he has no teeth, frantically sucks and frets; no constipation; some remission of the chest walls during inspiration; no marked tendring of the ribs. When disturbed he makes a crowing sound with inspiration. During this time there is marked withdrawing of the chest wall, leaving but few movements. At other times the breath is held tightly for a few seconds till he becomes blue in the face. He was ordered milk half a pint, and whey, one pint and a half daily, and some thimble-end soda. March 2.—Has had many attacks of 'crowing' and between the attacks there seems to be more or less constant spasms. March 4.—Child 11. Inflammation eye, ear, throat &c. not, not, not. He had six attacks yesterday no general convulsions. From this date he began to improve, the attacks becoming less. He went home on March 21 (weight 12 lb. 1 oz.), having had no attacks the last days or more.

Spasm of the glottis is sometimes the cause of death in cases when the obstruction is not complete, as in the following case. A boy of 1 year old had difficulty in breathing from birth, was seized with a bad attack and was admitted to hospital; there was undoubtedly obstruction to inspiration and

each recession of the chest walls, necessitating tracheotomy, which was followed by much relief. Death followed five hours later without apparent cause. At the *post-mortem* there were no signs of rickets; there was slight congestion of the larynx and the thyroid gland; all the other organs were healthy. Sudden death from spasm of the glottis occasionally occurs in cases of tuberculosis with enlarged and caseous mediastinal glands.

Diagnosis.—The following table gives the chief points:

<i>Laryngismus: Spasm of the Glottis.</i>	<i>Spasmodic Laryngitis (Wild Cough).</i>	<i>Membranous Cough.</i>
Occurs in infants, children under 18 months of age.	Rarely occurs under 2 years of age; commonest 2-7 years.	Occurs at all ages during childhood.
No fever, and no signs of laryngeal catarrh.	Slight fever, usually coryza and laryngeal catarrh.	Variable amount of fever, and perhaps some inflammation of the larynx.
Occurs at any period of the 24 hours, and often many times.	The attack occurs at night.	Mostly worse at night.
No cough, inspirations are stridulous.	Stridulous cough, stridulous expiration, irritative dyspnoea.	Stridulous cough, stridulous expiration, progressive dyspnoea.
Contraction of the hands, or general convulsions, not uncommon.	Convulsions rare.	Convulsions rare.
The attack lasts a few seconds, and frequently recurs.	Attack passes off in the course of an hour or two.	Becomes steadily worse, though variations occur in its progress.
Occasionally fatal.	Rarely fatal.	Very often fatal.

Prognosis.—The great majority of infants who suffer from 'child-crowing' recover; the prognosis, however, must always be a guarded one, and as long as there is any tendency to spasm of the glottis the child cannot be regarded as out of danger. A 'crowing' child may at any time have general convulsions and die in a few moments. Improvement in the child's general condition, and especially of its digestive powers, quickly leads to an improvement in the 'crowing'; this we have noticed in several cases which rapidly improved under the careful feeding and attention in the hospital, but which quickly relapsed again when they were discharged. An attack of bronchitis or bronchopneumonia is very likely to prove fatal in a child subject to laryngismus.

Treatment.—During the spasmodic stage when the breath is being held, every effort must be directed towards exciting reflexly the inspiratory respiratory centre. A sponge well wetted with cold water may be dashed into the face; pinching on the back; or a vigorous shake, will sometimes be successful. It is useful to have a hand fan within reach, and use it vigorously during an attack to fan the face.

We have found that hooking back the epiglottis with the forefinger has been followed by an inspiration. In one of our own cases a child who was subject to these attacks had a severe seizure while under chloroform for the removal of post-nasal adenoids, and his life was only saved by the rapid performance of tracheotomy. In such cases a catheter passed into the larynx would suffice to insure the entry of a small quantity of air.

The most useful medicines for temporary use to keep the attack in check are chloral, bromide, and minute doses of morphia. We should only give these drugs in the severe forms of spasms in order to soothe or render less irritable the unstable state of the nervous system. Five grains of hydriodate with two and a half of chloral may be given to an infant of 3 months, and repeated every six hours. A drop of liq. morphia may be given every six hours, its effect being carefully watched.

The most important part of the treatment is with regard to the diet and surroundings of the child. It is of the greatest importance that it should get fresh air. A steam tent and hot close room is the worst possible place for an infant suffering from laryngismus. A change away to the sea-side often works wonders, by improving the infant's digestive powers and general health. A food or foods must be found and given in quantities which the child can digest. It will probably be found that the child is taking more milk than it can digest, and is passing large pasty stools. The amount of milk must be diminished. Peptonised foods, cream mixtures, thin oatmeal gruel, beef juice, beef tea with vegetables, all have their value in these cases, if given in suitable quantities according to the child's digestive powers. Medicines which assist the digestion and regulate the bowels are often necessary: extract of malt, rhubarb and soda, acids and pepsine, and, above all, cod liver oil, when it can be taken and digested. Constipation must be removed. If a child has laryngismus and gross nasal adenoids, is it safe to operate? We have several times operated with great advantage, but it is necessary to be on the look-out for spasm of the glottis. Intubation may be performed or a catheter passed into the trachea, if necessary, and artificial respiration performed.

Spasmodic Laryngitis. Catarrhal Spasm. False Croup.

This affection differs from the last described in that it consists in a sudden but not complete stenosis of the glottis associated with a laryngeal or pharyngeal catarrh. A child, usually above 2 or 3 years of age, goes to bed apparently well, or there may be a slight hoarseness or cold in the throat; after a few hours' sleep he is suddenly awakened with alarming symptoms of laryngeal obstruction. There is a loud metallic cough, stridulous respiration most especially with inspiration, the dyspnoea and distress are very great, there is recession of the chest walls, and all the accessory muscles are called into requisition. The orthopnoea and distress are so great that death seems imminent. In the course of a few minutes, probably before the arrival of medical assistance, which is hastily summoned, the laryngeal obstruction has ceased, and the child, tired out by its uncoordinated exertions, falls into a quiet sleep. The symptoms of a catarrh or tracheitis persist for some days perhaps with some changing cough and more or less pronounced attacks of dyspnoea at night. Children who then suffer are extremely liable to a recurrence whenever they take cold, and it is not uncommon for mothers to say that their child is very subject to 'croup.' Though these attacks are alarming, they are rarely fatal, thus contrasting with laryngismus; but it must be remembered that the latter is frequently associated with general convulsions, and, moreover, occurs at an age when spasm of the glottis is necessarily

dangerous if caused on account of the weakness of the respiratory muscles and want of rigidity in the chest walls. Children who have chronically enlarged tonsils or nasal adenoids are exceedingly apt to suffer from spasmodic laryngitis.

These attacks of spasmodic croup differ very much in severity; in some cases they are very mild, but on account of their occurring at night, and the dread in which all forms of croup are held, they are exceedingly apt to alarm the friends. Several children in the same family may suffer, and there is often a history of these attacks to be obtained in other members of the family.

Treatment.—Great care should be exercised to protect children subject to such attacks from cold. A draft house or a damp situation should be avoided, and exposure to the cold raw winds of spring should be carefully guarded against. Great benefit is usually derived from residence at the seaside. Cold sponging with tepid salt and water every morning on getting up will greatly assist in keeping the child free from attacks. Warm woollen clothing should be worn next to the skin, and care taken that the legs and neck are well protected. Enlarged tonsils or adenoids must be removed. During the attack most relief is given by applying hot sponges to the throat and by administering an emetic of ipecacuanha powder (4 to 10 grains) or a teaspoonful or two of ipecacuanha wine. As the child gets older he becomes less and less liable to these attacks, which cease altogether before puberty is reached.

Catarhal Laryngitis

Children of all ages are liable to suffer from a catarrh of the larynx and trachea, though it is perhaps most common and is certainly most dangerous during the first two or three years of life. These attacks differ somewhat from those of spasmodic croup just described, inasmuch as there may be no violent exacerbation at night, yet in many cases all the symptoms are apt to be worse towards evening. In both cases there is laryngeal catarrh and laryngeal spasm, and they differ only in degree; in the spasmodic variety there is usually little catarrh, but severe attacks of spasm of the glottis; in the catarrhal variety the catarrh is much more severe, and perhaps the spasm is not well marked, but all these cases are apt to become much worse at night, apparently from the presence of more or less spasm. They are mostly the result of cold, exposure to cold winds or a chill, and they may be associated with measles, either belonging to the premonitory symptoms or following the disappearance of the rash. The attacks are preceded for the most part by coryza, feverishness and cough, the first suspicious symptom being the changed character of the cough, which is at first hoarse or hoarse, and then assumes the characteristic 'croupy' or 'brassy' character, which announces that there is some disease of the larynx. An examination of the fauces will probably show enlarged and congested tonsils with excessive secretion, and if the epiglottis can be seen, the mucous membrane will be found to be of a pinkish colour than usual; but it is rarely possible to get a view of the larynx by means of the laryngoscope. As the symptoms become more marked, the air is heard to enter the larynx with a hissing sound, there is dyspnoea, the alæ nasi work, the chest walls fall in during inspiration, and there is often much distress. In some

—as the child has to be propped up in bed, and pays no heed to its toys, its whole attention being taken up in its efforts to breathe. The fever is variable, rarely high, usually 100° to 102°; the pulse is quick and hard. In most cases the symptoms are milder than those just described, there being only a croupy cough and some acceleration of breathing. In the later stages the secretion becomes free and mucopurulent. On the other hand, the case may become so urgent that intubation or tracheotomy is required to stave off impending death, though usually the effects of treatment render this unnecessary. Cases of simple catarrhal laryngitis in children rarely present the picture of stenosis of the larynx which is seen in the membranous variety; there is probably the 'croupy' cough and frequent breathing, between wakes, especially after a fit of coughing, the child is comparatively comfortable, and falls into an easy sleep. The prognosis depends upon the diagnosis; if the case is one of catarrhal laryngitis and the child is over 2 or 3 years of age, there is strong probability that it will recover. The younger the child, the greater is the danger.

Treatment.—The first appearance of 'croupy' symptoms should never be neglected; the hard metallic cough, when once heard, should be the signal for placing the child in a warm room, where the temperature is maintained at 60° or 62° both day and night, giving at the same time fluid food or soup, demulcent drinks, and medicines which promote diaphoresis. If the symptoms become more pronounced, the child must be confined to its cot, and a tent rigged over it by means of sheets stretched over coals or a charcoal brazier, so as to protect the patient from draughts, and a moist atmosphere must be secured by the aid of the steam kettle. Some carbonic acid or tr. benzoin co. may be placed in the kettle. The temperature inside the tent should be maintained at about 70°, and steam from a kettle allowed to play freely into it, so as to render the air thoroughly warm and moist. The usual tendency of the friends of the patient is to overdo the steam and maintain too high a temperature, so that it is not uncommon to find the patient almost paralytised.

During the early stages of laryngitis, when there is much swelling of the mucous membrane of the larynx, with little secretion, the steam gives more or less, at least temporary, relief. This is most marked in the cases of hospital patients who have been much exposed before being admitted; in these cases the amount of relief given by the steam tent is often an important element in the diagnosis of catarrhal mucous-membranous croup. A steam kettle should be heated by means of a spirit lamp rather than by gas or by placing it on the fire, as in the latter case the patient's cot has to be placed close to the fire. The products of the combustion of gas are objectionable, especially in a small room. Local applications applied over the larynx in the form of hot sponges or spongio-piline wrung out of hot water are often of much service. The sponges should be taken out of the hot water and squeezed by wringing in a piece of flannel and used continuously; but if this exhausts the child too much, a piece of spongio-piline may be secured *in situ* by tape and renewed every half-hour. An emetic in this stage is of little value in relieving the breathing and producing free expectoration, ipecacuanha powder answering very well. Five grains may be given in syrup of oranges peel every ten minutes till vomiting is produced. Sulphate of copper

to gr. $\frac{1}{2}$ to gr. 1 doses, repeated in a few minutes, will generally produce vomiting. It is useless to repeat emetics if they fail to give relief. It need hardly be said that it is wrong to give emetics in the later stages, when the breathing has become laboured and the lips blue or pallid; to give emetics under these circumstances is to risk failure and to waste invaluable time. Of medicines, antimony unquestionably holds the first place, and in sthenic cases should be given with a free hand, though as an emetic it is too slow and nauseating. Either the wine or tartar emetic may be given, in combination with citrate of potash or acetate of ammonia. (F. 25.) Tartar emetic may be given in powder or in 'tablets,' gr. $\frac{1}{2}$ to gr. 2, every two or three hours according to age. Both ipecacuanha and aconite in small and repeated doses are useful.

The only food admissible is milk diluted with barley water or soda water, preferably given warm to assist in producing perspiration. In most cases of catarrhal laryngitis relief of the most urgent symptoms follows this line of treatment, though probably for several days many of the symptoms will remain, with exacerbations at night; in such cases the antimony may be pushed, nuxiating doses being given.

The question as to whether intubation or tracheotomy should be performed is always a difficult one, inasmuch as in many cases the most urgent symptoms will disappear under the influence of treatment, and the operation, even in the most skilful hands, adds another element of danger to the case. It is impossible to lay down any rule for the performance of the operation, or to select any one symptom which is to be taken as the signal. Dyspnoea and recession of the chest wall do not necessarily indicate any immediate danger, and most of us will have seen cases in which these have been indicating of the epiglottitis and ribs recover without operation. If, however, the case passes into a later stage in which the voice almost disappears, the respiration becomes laboured, all the respiratory muscles joining in the attempt to draw in air and expel it from the chest, while the distress and restlessness are on the increase, it is then quite certain that the time has come for affording relief. If there is marked pallor of the face, convulsions, delirium, or other symptom of toxæmia, there is not a moment to lose.

The difficulty is in large measure due to the uncertainty of our diagnosis. If we are sure that we are dealing with a case of catarrh pure and simple, even though the symptoms of obstruction are threatening we can afford to wait, and give our treatment a fair trial before proceeding to operate, knowing that much of the obstruction is due to spasm, which may at any time suddenly subside. Death from asphyxia must be very rare in a case of catarrhal laryngitis over two or three years of age. But it is comparatively seldom that we can make a certain diagnosis—at first, at any rate—between catarrhal and membranous laryngitis, as it may be only after tracheotomy has been performed, and sometimes even a day or two later, that membrane is coughed up. It is often not easy to decide as to the time for operative interference, but in a case where there was a history of the child having suffered before from 'croup,' and where the breathing tended to get worse at night and afterwards improved for a while at least, we should delay operative interference as long as possible, in the hope that improvement might take place. On the other hand, in a case that steadily got worse with-

out any intermissions, we should certainly advise operative interference in good time, as there would be little chance of a successful issue to the case unless the obstruction were relieved.

Membranous Laryngitis

Is membranous laryngitis always diphtheritic? Can there be diphtheria of the larynx without any tough membrane being present? In the great majority of cases there can be no doubt that if membrane be present the case is one of diphtheria. It may also be said that in the great majority of cases, if there is no membrane, there is no diphtheria. But in the present state of our knowledge it is not wise to take up a dogmatic position, except in so far as to view every case of laryngitis, whether we find membrane or not, with the greatest suspicion, as all such cases may turn out to be diphtheria, and we may regret when too late that we did not at first treat them as such. We must leave the discussion of the relation of membranous laryngitis to diphtheria to a later chapter (see DIPHTHERIA).

Symptoms.—The initial symptoms of membranous croup, whether diphtheritic or not, are practically identical, inasmuch as they are those of stenosis of the larynx. When the larynx is the primary seat of the attack the symptoms are those of croup, with restlessness, feverishness, and hoarse cough. In the course of a day or two, sometimes sooner, there is more or less loss of voice, and the cough has a peculiar ringing or metallic character, which is very characteristic.

It now becomes evident that there is some obstruction in the larynx, as the air enters the trachea with a hissing or stridulous sound, and the child is constantly endeavouring to cough something up and clutches at its neck as if to remove some obstruction. The tonsils are usually swollen, the fauces reddened, and perhaps the seat of false membrane. There is marked restlessness; the child wants to be moved, then put back again into its cot, perhaps get a few minutes' sleep, waking up with a hoarse cough and difficulty of breathing. The voice now is nearly lost, the child speaking in a whisper and making itself understood with difficulty. There is marked dyspnoea, which tends to increase as the disease progresses; the alar nasi dilate, the extra-inspiratory muscles are called into action, and the epigastrium and inferior lateral region of the chest, the intercostal spaces, and supra-sternal fossa are drawn in during inspiration. The expiratory efforts are laboured, so that the abdominal muscles act with some force, and the air escapes through the larynx with a noisy sound. So laboured and noisy is the breathing that it can be heard some distance off. While the child goes from bad to worse, there are usually more or less marked exacerbations; the child is easier after a fit of coughing, during which mucus or perhaps some membrane is actually dislodged. All the symptoms are apt to be worse at night.

If no relief is obtained the symptoms of *locustia* begin to present themselves. There is a marked pallor or lividity about the lips and face; perspirations break out on the forehead; the restlessness is often intense; the child is perhaps drowsy and delirious, perhaps attempting to get out of bed; presently complete insensibility comes on, the pupils dilate, the attempts at respiration become more and more feeble, and death quickly ensues. The

temperature is usually raised a degree or two in the earlier stages, but may be subnormal as the blood becomes more viscous. An examination of the chest does not always yield positive results as to the state of the lungs. The whistling or stridulous sound produced in the larynx is heard all over the chest, masking the vesicular breath sounds, and making it difficult to diagnose the condition of the lung. The suprasternal region is from usually audibly resonant from the presence of emphysema, while at the bases posteriorly the resonance is mostly impaired on account of the lung being collapsed, or air entering it very imperfectly. The diagnosis of pneumonia is difficult in the absence of impaired resonance, as the typical signs may be wanting on account of the small supply of air entering the chest; moreover, the pneumonic consolidation may be masked by emphysema. It is difficult to diagnose the presence of membrane in the trachea and bronchi; but if after tracheotomy has been performed the breathing is still laboured with infrasonic of the chest walls, there will be strong reason to suspect that the bronchi are obstructed by membrane.

When the larynx is affected secondarily the symptoms are frequently much less marked, more especially if the membrane only spreads to the larynx after it has existed for some days in the pharynx or nasal mucous membrane. In this case the weakness and depression which exist before the laryngeal complication supervenes mask the symptoms of laryngeal stenosis. There is usually much less dyspnoea and distress than when a healthy child is suddenly attacked. When the primary seat of the membrane is in the bronchi and it ascends to the larynx, the symptoms closely resemble purulent bronchitis, as in the following case:

Autopsy Epistaxis. Case.—Thomas, Man., 2 years. Boy was quite well till February 1. He complained of his throat, and became hoarse; he had also a cough. On February 3 he came to the Throat Hospital, where examination showed the cords and larynx were healthy. February 12.—Seen by Mr. Westwood at the Children's Dispensary: Inflammation and signs of bronchitis were noted, and he was sent to hospital. On admission he is a well-nourished boy, somewhat emaciated, but a good colour. There is resonance of the lower part of the chest. Pulse, 100; respiration, 30; temperature, 99.8°; chest resonant. Rhonchi heard all over chest. No enlarged glands to be felt, some diffuse redness of fauces; no membrane. Stools soft; sick twice after milk, sporan. 25. 28. February 12.—There is more marked moroseness than yesterday; spits some purulent mucus; rales heard in chest. At noon, consultation by Mr. Lee, coughed up much stringy mucus. Temperature 99-100°; no membrane. February 13.—Respiration easy; tube inserted. Temperature 101°. February 14.—Tube removed; breathes easily, but coughs up a good deal of greenish pus. Urine contains a trace of albumen. February 15.—Respiration easy; no membrane; sputa a large amount of albumen. Irrigation at 10.25; coughed tube up in a few minutes. Intubation again at 1 p.m.; much mucus-pus coughed up. February 17.—Child much worse; great pallor. Respiration 30°. Urine scanty; large amount of albumen; weak pulse, low tension. February 18.—Tracheotomy this morning, dyspnoea subsiding; no membrane seen. Child died of uræmic early morning. *Post-mortem.*—This membrane extending down the trachea and bronchi to the smallest bronchi in the lungs; much mucus present. Some membrane on the epiglottis and larynx; none on the fauces or nose.

Albuminuria exists in a large number of cases in the early stages, in nearly all in the later stages; the urine may be highly albuminous and scanty. Occasionally there may be suppression of urine and uræmic symptoms.

Diagnosis.—The diagnosis of stenosis of the larynx is not difficult, nor is

it likely to be confounded with bronchitis or laryngo-pneumonia when the obstruction resides in the bronchial tubes, in which there is extensive consolidation of the lung. In laryngeal stenosis the air rushes through the larynx, giving rise to a crowing or stridulous sound, especially during inspiration, but there is obstruction to the expiration also; the respiratory movements are laboured, as if to overcome the obstruction, and with this there is marked recession or sucking in of the chest walls during inspiration. There is loss or great impairment of voice. In pneumonia or bronchial obstruction, the dyspnoea may be great and the respirations frequent, with much in drawing of the chest wall, but there is no stridor or loss of voice. The diagnosis of obstruction of the bronchial tubes, in addition to stenosis of the larynx, as in those cases where the membrane has spread downwards or where there is an accumulation of mucus below the larynx, is difficult and uncertain; but in all such cases the dyspnoea will be great, and tracheotomy urgently required, and the presence of obstructed bronchi would not contraindicate operation, as an opening in the trachea would favour the coughing up of the obstructing material.

The differential diagnosis of catarrhal, membranous, and diphtheritic croup is generally a matter of great difficulty, and until the case has continued under observation for some hours or days often impossible. Even after tracheotomy has been performed, the nature of the case may still be doubtful, inasmuch as thick fibrous mucus may be coughed up with no distinct membrane, and recovery may take place without the diagnosis having been determined. The question of diphtheria or not diphtheria is one of the greatest importance, but unfortunately there is not much that can be said with certainty. It is easy to say that in diphtheritic croup there is æthemia, while in membranous laryngitis the attack is sthenic in nature. But, as a matter of fact, it occurs in practice that if the primary seat of the diphtheria is the larynx, the first and only symptoms are those of stenosis of the larynx, and the pallor and depression and æthemia which result are due to the toxæmia produced by want of oxygen, rather than by the working of the diphtheritic poison. It is for this reason that the symptoms of membranous formations are practically the same whether produced by diphtheria or not. If, however, the larynx is affected after the existence for some days of diphtheria of the fauces, the symptoms are necessarily modified. The diagnosis of diphtheria when primarily situated in the larynx has often to be made less from the symptoms of the patient than from his surroundings.

If diphtheria is epidemic at the time, or if the fauces are covered with membrane, or there is albumen present in the urine, the case is almost certainly diphtheritic. The discovery of Loeffler's *D-bacillus* in the secretions would place the diagnosis beyond doubt.

Stenosis of the larynx may be caused in other ways than by the existence of membrane; the larynx may be compressed by an abscess situated posteriorly between the larynx and œsophagus, or even laterally; in this case there will be difficulty of swallowing as well as dyspnoea. The trachea may be compressed below the larynx by an enlarged thyroid or new growth, but the history of the case as well as the local enlargements would distinguish between the two. In infants and young children spasm of the glottis will in rare cases simulate membranous laryngitis, as in the case given (p. 186).

The diagnosis may be difficult, but the absence of fever would point to spasm; it is rare, however, for any spasmodic affection to come on gradually and progress from bad to worse, as is the case with diphtheritic laryngitis. In the following two cases, gastro-hyphostoma on the trachea gave rise to dyspnoea; in one tracheotomy was performed without relief.

Tubercular Abscess of the Thymus: Pressure on the Trachea: Tracheotomy.—Margaret S., aged 22 months: admitted November 24, 1890. Mother states she had been weakly from birth and subject to bronchitis. Five days ago she began to cough and breathe with difficulty. Swells a good deal, and cannot lie down; her lips are blue at times.

On admission the child was cyanosed and there was much restlessness; she was given five teaspoonfuls of *vin. ipecac.* in divided doses, but she was not sick. A few hours after tracheotomy was performed by Mr. Westmacott, but it failed to relieve the breathing, and she died two hours after.

Post-mortem.—On removing the sternum an enlarged thymus was noted, extending from the upper border of the sternum to the bifurcation of the trachea, and lying in contact with the trachea, and evidently compressing it. Some curious lymphatic glands were adjacent to the mass. On section it was found to contain a large abscess cavity filled with thick pus. There were some milary tubercles and broncho-pneumonia in both lungs.

Crisis of Cervical Spina: Abscess compressing Oesophagus and Trachea.—Richard L., aged 3 years: admitted February 10, 1890. Mother states for the last fortnight he has had a hoarse cough and wheezing; he gets feverish and restless at night. On examination it was noted he had a hoarse metallic cough and hoarse voice; prolonged expiration and wheezing all over the chest. March 10.—For the last week the breathing has been much worse, noisy, and markedly stridulous; the cough metallic, and some recession of the chest. April 12.—Breathes with a noisy sound; has attacks of difficult breathing at night; gets blue and distressed. Air enters the chest with a long-drawn whistling sound, is held, and then slowly goes out. Resonance is lost over the sternum. Face puffly; unenlarged veins. May 22.—Lips and fingers somewhat cyanosed. Gets up if awake, but when asleep lies down, though always found worse on being awoken. Swallows solid and liquid fairly well. July 20.—Temperature been irregular since last note; wakes up to vomit. Breathing has improved of late; there is a tendency to choke when he feeds. September 18.—All laryngeal symptoms have disappeared. Chokes when he feeds; no post-pharyngeal abscess; no pain in the neck, but he cannot hold his head up, and the last two cervical vertebrae are very prominent; he cries with pain if his head is tilted. Temperature 98° in 1st. October 23.—Much worse; for some time past has been wasting; looks fretful; had a bad attack of dyspnoea early this morning; much vomiting, pus running from nose and mouth. Death October 25.

Post-mortem.—Mediastinal glands enlarged, but not cancerous; a small cystic at the apex of left lung; bronchitis, but not tubercle. In upper part of the posterior mediastinum, and behind the oesophagus, is an abscess cavity holding about 15; it has compressed the oesophagus and opened into it. Posterior wall of abscess cavity formed by united membranes in position of seventh cervical and upper three dorsal ribs, the latter having completely disappeared.

Pathological Anatomy.—The post-mortem appearances found in those who have died of membranous or diphtheritic croup differ according to the immediate cause of death. In the majority of cases this is due to the formation of membrane below the tracheotomy wound and to the lungs becoming choked or collapsed. In such cases membrane may be found beginning at the epiglottis and extending downwards to the smallest bronchi. As a rule the membrane is tough and firmly adherent to the epiglottis and larynx, being separated with difficulty, while lower down the membrane is far less

tough and is much more easily detached; the bronchi usually contain semi-purulent fluid, and the bases of the lungs are usually pneumoniaic or collapsed while the apices are emphysematous. In some cases death results from asphæxia or from septic poisoning, the result of the diphtheritic infection; in such cases the trachea and bronchi may be free from secretion. It is accordingly rare to find at the *post mortem* that the membrane is confined to the larynx in those cases where tracheotomy has been performed.

Treatment.—Every case of laryngitis occurring in a child should be at once isolated, as what may appear in the early stages to be a mild case of catarrhal laryngitis may in the end prove to be diphtheritic. There are mild attacks of diphtheria of the larynx, just as there are mild cases of diphtheria of the tonsils and fauces. In the early stages the secretion coughed up may be mucopurulent only, and later, either before or after tracheotomy or intubation has been performed, the secretion may be membranous.

Much that has been said under the head of treatment in catarrhal laryngitis will apply to the treatment of diphtheritic laryngitis. A warm foot should be provided, and warmth and heat should be applied externally to the larynx, though any blistering or abrasion of the skin must be carefully avoided. If the case is certainly one of diphtheria, we doubt the value of either emetics or expectorants. If there is membrane in the larynx there is small chance of its being loosened or detached by these means. But, assuming the case is seen in an early stage, no harm can be done by an emetic of ipecacuanha; Dr. W. P. Northrup recommends the yellow sulphate of mercury in 5-grain doses. Emetics in the later stage are useless and harmful. We must chiefly rely on the application of steam from a steam-spray apparatus charged with some antiseptic, and, above all, in relieving the stenosis of the larynx by intubation or tracheotomy. The most useful antiseptic is bichloride of mercury; carbolic acid, thymol, and oil of peppermint are also useful. Calomel fumigation has been used with some success in America, and is certainly worth a trial. Dr. Northrup recommends that a tent be rigged up over the cot by means of sheets, made fairly airtight and of about 30 cubic feet capacity. 15 grains of calomel are volatilised every two hours for two days and two nights, and then at intervals of three hours for the next twenty-four hours. The calomel is volatilised by means of a tin plate heated by a spirit lamp, and placed over a bowl of water so as to prevent fire in case of an upset. This treatment does not produce pyrexia; if rained on too long stomatitis, diarrhoea, and anaemia may supervene. The mouth should be kept scrubbed out, and any secretion coughed up must at once be removed and disinfected. The medicinal treatment appropriate for diphtheria should be given (see *opos.*). The only food should consist of milk.

Tracheotomy.—The operation of opening the trachea in cases of membranous laryngitis must be looked upon as a means of relieving the tracheal obstruction to respiration; it can in no way influence the constitutional effects of the disease, though it may prevent the addition of gradual asphyxia to the other depressing influences of the poison. Further, we may, by the operation, prevent the spread of the membrane down the trachea, and thus, perhaps, lessen the risk of absorption of the virus as well as get rid of the obstruction.¹ What certainly may be looked for from the operation is this:

¹ Vide R. W. Parker.

death from mechanical obstruction to the upper segment of the windpipe may be averted, and that the distress caused by dyspnoea may to a great degree be relieved. It must not be forgotten that tracheotomy has its own dangers: first, those of the operation itself—haemorrhage, injury to important neighbouring structures, and entrance of blood into the trachea; later, there are the dangers of septic absorption, the exposure of a raw surface to the diphtheritic poison, tracheitis, pneumonia, and so on, from exposure of the tracheal mucous membrane to cold; that this is a real danger a paper of Dr. Wilson shows.¹

While we have thus indicated the objections to and the limited uses of the operation, we would yet urge its performance in all cases where there is severe dyspnoea; we have no means of knowing that the child will die of oedema, we do know that he will die of suffocation if unrelieved, and the other dangers mentioned are all usually avoidable by careful operating and after-management.

Extreme prostration without distinct evidence of asphyxia, and the presence of pneumonia or capillary bronchitis, may be looked upon as indications that tracheotomy will be of no avail. If tracheotomy is otherwise indicated, the presence of bronchitis may not in all cases prevent the operation being successful. We have seen a case in which it succeeded perfectly under these circumstances as far as relieving the dyspnoea went, though the child died, when apparently convalescent, from ulceration into the innominate artery.

The younger the child the earlier should tracheotomy be done; indeed, in children under three years once there is oedema in the larynx there is little hope but in tracheotomy; but see p. 208. Inasmuch as the operation is nearly always one of urgency, we must be prepared to do it under unfavourable circumstances as regards nursing, light, help, and appliances. It is, however, usually possible to improvise fairly serviceable arrangements for the operation itself. A dressing table on the top of a chest of drawers in private houses is the usual operating table. Candles give generally the best obtainable light when, as is so often the case, the operation has to be done at night, and care must be taken that the lights are entrusted only to those members of the household who can be depended upon to bear seeing the operation. These makeshift arrangements, together with the small size and anatomical relations of the parts, the urgency of the case, and the movements of the trachea in difficult respiration, make this operation, though often lightly spoken of, one of the most arduous in surgery.

If possible, at least one skilled assistant should be obtained besides the tracheotomist. As regards anaesthetics, it is in our opinion a question to be settled for each case; if the child is so asphyxiated as to be unconscious of pain, and not likely to struggle, it is far better to do without an anæsthetic. We have seen chloroform prove fatal before the operation was begun; on the other hand, if the case is operated upon earlier, and the child is conscious and restless, it is on all grounds better to give chloroform.

The child then should be placed upon a table of convenient height, and the lights, if necessary, arranged carefully. Everything required in the operation should be laid out upon a table or chair ready to hand before the

child is taken out of bed, since at any moment the moving or the giving of the anæsthetic may increase asphyxia and demand instant action.

As soon as the child is unconscious, and not before, since it increases the dyspnoea, one pillow should be taken from beneath the head and placed under the shoulders, so that the head falls back and fully exposes the front of the neck. Parker recommends a wine bottle wrapped in a towel as a neck support. The head must be held by an assistant exactly straight, so as to avoid any chance of the operator missing the mid line of the neck. The thyroid cartilage is then to be felt for, and an incision, one and a half to two inches in length, according to the size of the child, made in the middle line from the lower border of the thyroid cartilage downwards nearly to the

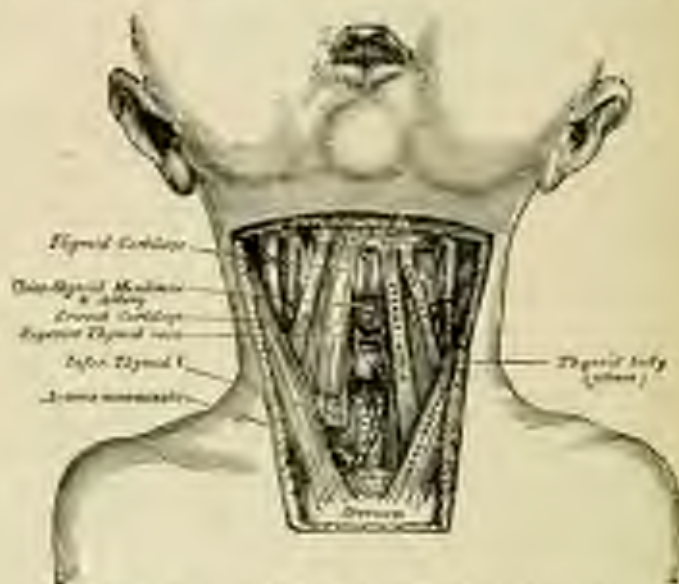


Fig. 34.—Anatomy of Child's Trachea. (From "Gray's Anatomy.")

top of the sternum. The first incision should be carried through the skin and subcutaneous fat; the second assistant should then draw the edges of the wound apart with retractors, and the operator should by successive cuts divide the tissues until he reaches the intermuscular septum between the sternohyoids or lower down between the sternothyroids: on reaching this he should with a director bear through the line of junction, and the assistant should take them up with retractors. The tracheal facets will now be exposed, and should be torn through in like manner, and the trachea laid. The tracheal hook is next fixed to the trachea, and drawn slightly forwards so as to steady the snarepipe and make it prominent; a short, somewhat round-shouldered knife—i.e. one rounded at the back and acutely straight in front—is then made to pierce the trachea, and as soon as it has entered

the handle is slightly depressed, and the windpipe is divided from below upwards for at least three-quarters of an inch. The knife is now laid aside, the dilator passed into the trachea and opened, and the hook removed; a free blast of air and the driving out often of mucus or of mucus-balls follows. If the trachea is free from membrane, the tracheotomy tube fitted with tapes is then passed in between or above the dilator blades, and the dilator is removed; as soon as a blast of air through the tube shows that it is in place, the tapes should be tied round the neck, and the operation is over. The child should be kept upon the table well wrapped up, with a warm sponge over the tube, for a short time to recover itself, and that it may be seen that there is no bleeding or other complication; after a quarter of an hour the inner tube may be put in after clearing away all coughed-up matter, and the child should be put into its cot and the steam kettle arranged.

Such are the general outlines of the course of an operation in which there have been no complications and no hurry; it is, however, seldom that such a favourable state of things occurs, and it will be convenient to consider more in detail the various difficulties that may arise. First, then, one or more large veins, inferior thyroid or branches of the anterior jugular, may be met with; if there is no urgency these may be ligatured, either before or immediately after division, or compressed by forceps applied. Should, by any rare chance, an artery of any size be wounded, it must of course be treated in the same way. In all cases the veins are necessarily intensely congested when dyspnoea is marked. In order to avoid danger of wounding veins, some surgeons lay aside the knife after the first incision and tear through the tissues down to the trachea with dissecting forceps or director.

Next, the most rigid case must be taken to keep in the middle line; in young fat children it is not difficult to miss the trachea, which in them is not only small, but so soft as to be readily compressed or pushed aside and so missed. Everyone has heard of, if not seen, cases in which the dissection has been carried to one side of the trachea, and thus the great vessels &c. endangered. In tracheotomy lay down, the anterior jugular vein is the vessel most likely to be injured. This is, of course, of minor importance.

The depth of the trachea must also be remembered, and the fact that it recedes from the surface towards the lower part of the neck. The deep incisions must not be carried too close to the sternum, as the important vessels will be endangered, nor must the trachea be opened so high up as to divide the thyroid cartilage and probably injure the vocal cords; it is well, however, to get as low an opening as practicable, in order, if possible, to be clear of the obstruction.

No regard need be paid to the thyroid gland, nor should any attempt be made in children to make a 'superior' or 'inferior' tracheotomy. In almost every case in which the operation has been done examination will show that two or three rings of the trachea and the cricoid cartilage, together with, of course, the isthmus of the thyroid gland, have been divided—that, in fact, a laryngo-tracheotomy has been done, and this is as good as any other operation.

It is not by any means necessary to use a tracheal hook; if it is not employed, the left forefinger should be used as a guide and the trachea steadied

by it or between it and the left thumb while the knife is carried upwards to the side of the finger or between it and the thumb; in many cases, however, the hook does undoubtedly simplify the operation.

It is of great importance to have the skin wound very free, both to give room for the deeper steps of the operation and to prevent the possibility of discharge or air being pent up in the cellular tissue of the wound; no sutures should ever be put in. The tracheal opening should be large, median, and vertical; nothing is gained by a small opening, and much trouble may arise in inserting the tube. The knife should enter the trachea somewhat sharply, but not with a stab or plunge which would endanger the posterior wall; cases have been recorded where the knife failed to pierce the mucous membrane, and hence the tube was passed into the subcutaneous tissue; in other instances a tough diphtheritic membrane has been pushed before the knife and tube—under either condition, of course, no relief was obtained by the operation.

If there is any large collection of membrane or of thick mucus in the trachea, the tube should not be inserted at once, but the edges of the tracheal wound should be held apart for the child to freely cough out the contents of the air passages, and for the surgeon to clear them away and examine the surface of the trachea so as to pick off any visible membrane above or below the opening. Parker advises the systematic use of the dilator and syringing out the trachea and larynx with a feather dipped in solution of carbonate of soda before putting in the tube.

The tracheal aperture may be held open either with the dilator or with artery forceps, or Gilding-Bird's dilator may be worn for a time.

In inserting the tube it is sometimes difficult to get it into the dilator-slit in the trachea; under these circumstances the dilator is useful, or if one is not at hand, our end of the opening may be depressed by the finger so as to make the aperture gape. A buxus tube is of course the easiest to insert for this reason, though it is not by any means the best variety. The surgeon should never be satisfied that the trachea is properly opened unless free blasts of air are driven out on coughing, nor that the tube is in the wind-pipe unless air and mucus are blown out through the tube freely.

The instrument most commonly used to clear the trachea of secretion is a feather; some of the shorter tail feathers of a pheasant will be found the best—if the longer ones are used, the end which is too flexible should be cut off. We have had some common brush pipe cleaners tipped with coralline for this purpose, and also a miniature bristle probing made to sweep out the trachea. Membrane can often be picked out with forceps. Aspirators of all kinds are of use chiefly if not solely for blood and the thinner form of mucus; adherent membrane and thick mucus cannot be drawn out by them; neither is sucking by the mouth any better, hence it is not worth the risk to the operator. Anyone who has tried it will know how impossible it is to suck out anything except the fluid material, and even for this suction is often unsuccessful. Parker, however, strongly advocates the use of aspirators after loosening and softening the membrane by instillation of carbonate of soda.¹ Where breathing has ceased or is becoming very feeble, artificial respiration

¹ Rode carbont. 3j, glyster ʒj, water to fill (Parker).

should be performed, and if necessary a catheter may be passed down the trachea and the lungs inflated.¹

Such are the more important points about the operation itself in cases where everything can be done deliberately and Tronseau's classical advice, '*Opère lentement, très lentement*,' followed. In many cases, however, if the operator is slow the child will be dead before the trachea is opened, and if not actually dead the almost complete asphyxia will seriously add to the dangers of the case. Under such circumstances it is necessary to cut the steps of the operation short; a free incision through the skin, another down to the trachea, and the third upwards in the trachea itself. We have often had to operate in this way with three cuts, using no instrument except the knife and the tracheotomy tube; after the first two incisions the left forefinger is passed down to the trachea, which is stretched by it; the opening is made and the finger kept as a guide for the tube, which is at once inserted. The finger and thumb may be usefully employed to push back the tissues on each side and, as it were, press forward the trachea. In some cases there is free bleeding for a moment or two from the engorged veins; this must be neglected, the tube put in at once, and the child instantly turned over on its face to prevent any blood from running into the trachea; as soon as air enters the lungs freely the circulation is re-established and the venous bleeding ceases without any treatment. The objection to this mode of operating is that it is of course more difficult, and there is some risk of blood getting into the air passages; it is, however, necessary in some cases. In very urgent suffocation the operation may even be done in one session through skin and trachea upwards, but this can hardly ever be necessary, and has several objections, the chief being that in children the trachea can by no means always be felt through the skin, and there is great likelihood of emphysema from insufficiency of the superficial wound.² Even if the child is apparently dead before the trachea is opened, the operation should be rapidly completed, a long feather passed down the trachea and withdrawn, and the artificial respiration performed. Recovery will often follow even if respiration has ceased for what appears a very long time.

It is well to remember that venous bleeding in tracheotomy is always more formidable in appearance than in reality, and always ceases at once after the trachea is freely opened.

Emphysema occurring at the time of the operation is due to too small a skin wound or to opening up the cellular tissue in attempts to pass the tube; it may be very extensive and spread down into the thorax; in such cases it is sometimes fatal from pressure upon the lungs. Champneys has shown experimentally that there is serious danger of mediastinal emphysema and pneumo-thorax when artificial respiration or sudden violent inspiratory effort is made after division of the deep cervical fascia; hence the tube or dilator should be put in quickly and the fascia disturbed as little as possible.³

A possible danger from entry of air into a wounded vein need only be

¹ *Life Savings, Arch. Pediatr.* September 1884.

² St. Germain operates by one incision downwards, beginning by performing tracheo-hyoid anastomosis. Neither this plan nor operation with the thermocautery has anything to recommend it.

³ *Med.-Chir. Trans.* 1884.

mentioned; instant pressure on the vein and rapid opening of the trachea are the remedies.

Opinions differ greatly as to the best form of tracheotomy tube for immediate use. The barbit is the easiest to insert; the lobster-tailed tube of Darbarn is open to the objection that it is very difficult to clean; probably Parker's so-called angular tube is the best, and is certainly anatomically the most correct; it has also the advantage of being polished inside. It is, however, a matter of little importance what shape of tube is put in for the first few hours, provided it is of sufficient size and has a movable shield to allow it to lie evenly. The largest size that the trachea will admit should always be used to give as much breathing space as possible and to prevent play of the tube in the trachea. Parker has shown that the diameter of the windpipe is exceedingly variable, and no rules for size in correspondence with age can be given. In any case it is advisable to change the tube after twenty-four or forty-eight hours, and this gives time for the substitution of a Parker's tube for any other that may have been used at the moment. After twenty-six hours the metal tube can often be replaced by a Moorman's rubber tube, or at least a metal tube of different length from that first employed, or, better still, the tube may be in favourable cases left out altogether.

As soon as the trachea has been cleared and the child has become quiet after the operation, i.e. usually in about half an hour or less, the child should be removed to the tent, the arrangement of which has been already described.

The lower part of the wound should be dusted over with iodoform, and a piece of gauze slipped beneath the shield of the tube to protect the skin and wound from it. If the edge of the shield cuts into the wound, the tube does not fit well and probably the inner end is pressing upon the tracheal wall; it is either too long in the straight part or the curve is wrong. A single layer of gauze wet with a 40 carbolic or some other antiseptic solution should be laid over the mouth of the tube and removed when there is any coughing.

The child must be constantly watched, and at the least sign of dyspnoea or any cough the tube should be cleared with a feather, and coughing excited, watching for the moment when mucus appears at the mouth of the tube to wipe it away before it is drawn in again. The inner tube should be put in as soon as the child has settled down, and taken out every half-hour or oftener at first to be cleaned. Special watch must be kept for any sudden plugging of the tube by pieces of detached membrane or thick mucus—a frequent cause of sudden death after tracheotomy—immediate removal of the tube and membrane is required in such circumstances. Abundant discharge of thin mucus is a good sign, in so far as there is less likelihood of there being any membrane in the trachea if free secretion occurs.

After-management.—Success in the results of tracheotomy cases depends more upon after-management than upon anything else, and if surgeons could nurse their own cases the mortality after the operation would be much less. Constant watchfulness, readiness to remove the tube altogether and clean out



FIG. 15.—Parker's Tube.

the trachea—if membrane continues to form, this should be done at least once daily; the timely administration of stimulants, regulation of temperature and moisture are essentials, and can only be satisfactorily seen to by the surgeon himself. Cocks¹ well insists upon this, and points out that sudden obstruction is most often due to impregnated mucus, not to membrane; this thick mucus is secreted generally about twenty-four hours after the operation, and at the end of three or four days the discharge becomes thinner and more puriform (Jestings).

It is well to feed the child by earliest excitata for the first few hours, but if he is thirsty a few teaspoonfuls of ice milk may be given. During the first few days the milk not infrequently comes out in part through the tracheotomy tube from imperfect closure of the glottis during deglutition, and not, as might be supposed, from any accident to the œsophagus; on account of this occurrence it has been advised to give more solid food by the mouth. A certain amount of risk is incurred from this imperfect power of swallowing, in that food may pass into the lungs and set up the so-called "deglutition pneumonia;" any such danger may be avoided, as pointed out by Dr. Habershon, jun., by feeding the child through a soft catheter; from 2 to 6 oz. of milk may be given in this way every four hours,² but the plan is rarely required.

If possible the tracheotomy tube should be removed altogether on the fourth or fifth day, but this must depend upon how far the disease has subsided; if membrane is still coming away, the tube must remain, and it may be the eighth or tenth day before it is got rid of. If, as not infrequently happens, the dyspnoea returns on closure of the orifice of the tube with the finger (always supposing that the tube has a perforation at the bend) or on removal, the difficulty is due to the presence either of membrane or of granulation tissue, which may form a polypoid mass springing from the site of some patch of membrane, from the edge of the wound, or from an ulcer due to the pressure of the tube. Granulation masses, according to Parker, are most common about the fourth to the eighth day, and may be expected if there are coherent masses on the margin of the tracheal wound. Merrell Macdonald says they occur from the fifteenth to the thirtieth day, never after two months. Parker treats them by the application of nitrate of silver. Black patches seen on the outer tube when it is removed are said to indicate ulceration at the corresponding spot of the trachea, and should be looked upon as an indication for change of the tube to one of different length (Parker). Or the dyspnoea may be due to adhesions in the larynx or possibly paralysis of the laryngeal muscles, inflammatory softening of the trachea, or swelling of the mucous membrane.

Where, then, the tube cannot be removed entirely after the fifth day, the metal one should be replaced by a rubber one, or frequent changes made in the length of the tube, and daily attempts made to dispense with the tube altogether. Should the obstruction continue, search must be made for its cause; the most common is the granulation mass which may sometimes be seen on using the dilator and be removed, its base being touched with nitrate of silver. Failing this, it is well to wait a week or so and allow the child to regain strength; it should then be examined under an æsthetic,

¹ *Annals of Pediatrics*, January 1884.

² *St. Bartholomew's Reports*, 1885.

and, failing the finding of granulations or other obvious cause, a double probe should be passed up through the glottis from below and a piece of silk carrying a small sponge be attached to it; the probe should then be drawn out through the mouth, and the sponge carried through the larynx sweeps it out, breaks down any adhesions, and clears away mucus or any granulations there may be. We have by this means succeeded in restoring the breathing powers after many attempts at doing without the tube for a long time.

The dangers, then, of the too prolonged retention of the tube are the possible development of granulation masses and ulceration of the trachea, which may either lead to hæmorrhage from perforating the transverse artery or vein, or to subsequent tracheal stenosis from cicatricial stricture. Rogers, in 1859, and Healy (*La Presse Médicale*, November 29, 1884), estimated that in about one in five of the cases of tracheotomy there is ulceration of the trachea, but these results are from post-mortem observations. The ulceration may be either on the anterior or posterior wall of the trachea and gives rise to no special symptoms at the time, unless some important vessel is opened.

Sometimes acute nervousness and fear of suffocation prevent the removal of the tube; in such cases attempts must be gradually made by the use of a tube with a large fenestra to allow the passage of air through the larynx, while the external orifice of the tube is closed with the finger or a cork for gradually increased periods of time. Careful watch must always be kept upon these cases for fear of sudden asphyxia, which may come on after removal of the tube, as soon as the tracheal orifice becomes small, or even later than this from growth of granulations from the inner surface of the wound. In such cases the wound may require to be reopened and the tube to be inserted afresh. In some few cases the tube can never be dispensed with, and has to be worn permanently; but usually some cause of obstruction can be found. Sometimes a tough dense cicatricial membrane forms about the lower aperture of the larynx or upper part of the trachea, and requires removal by enlargement of the tracheotomy opening or by thyrotomy. Inhalation with or without removal of cicatricial tissue is effectual in some cases.¹ In any case where the tube has to be long retained, great care must be taken to avoid ulceration and to see that the tube is not corroded; it has several times happened that the tube has dropped off the shield and fallen into the trachea after long wear.

As to the application of lotions &c. to the interior of the trachea after operation, the number of specifics is as great as that for the throat; the soda lotion and lime water² do, no doubt, soften the membrane and mucus, and allow it to be more easily detached; of the other remedies probably the best is the instillation of 2 or 3 drops of 1-2000 mercurial solution. The applications may be made with a brush or spray producer, or a drop or two may be instilled through the tube from time to time. Smearing the tube each time it is replaced with iodoform ointment is a good plan. The wound should be washed over daily with a solution of perchloride of mercury (1-2000), and then powdered with equal parts of iodoform and boric acid.

After the operation the child is greatly relieved, usually falls asleep, and will

¹ *Child Vita and Breck, Lancet*, January 29, 1895.

² Lime-water is soon rendered inefficient by the CO_2 of the expired air.

goes on well for twenty-four or forty-eight hours, and then in fatal cases death occurs, often suddenly. This sudden death may be due to various causes: sticking of the tube with detached membrane or mucus, extension downwards of the disease, possibly irritation of the vagus (Parker), simple ashenia or poisoning by the disease, pneumonia, or cardiac failure.

There is no doubt that the majority of cases of tracheotomy for diphtheria die; the mortality varies with the epidemic and with the operator, for necessarily the surgeon who will only operate in the most favourable cases will have a lower mortality than he who gives a chance of relief to less hopeful cases as well. Hence statistics are of no value. It is, however, roughly true that a large proportion of the cases described as *croup* recover after tracheotomy, while those classed as diphtheria mostly die.

Age has a very important bearing on the success of the operation. Children under 2 years comparatively seldom recover; the feebleness of the child, the increased difficulty of the operation and of the subsequent management, all make the prospect at this age worse. R. W. Parker has had 50 per cent. of successes in his own practice, but this must be considered far better than the average result.*

Andr  bault, in the Paris Children's Hospital, gives the following table of tracheotomy cases:

	Cases	Recoveries
1-2 years	976	804
3-4 "	810	175
4-5 "	726	174
5-6 "	497	128
above 6 "	547	108

For the general management and feeding of diphtheria cases, as well as for the treatment of the fauces and mouth, see DYPHTHERIA.

Apart from diphtheria or croup, tracheotomy may have to be considered in cases of *colds of the glottis*, usually the result of an attempt to drink from the spout of a tea-kettle. In such cases, as Dr. Wilson has shown, a false membrane may be produced exactly like that of diphtheria.[†] The symptoms usually come on immediately, and in slight cases soon subside if the child is kept in bed in a warm moist atmosphere. Sudden spasm, bronchitis, and pneumonia, and the formation of false membrane are the chief dangers. The treatment of such cases consists in keeping the child in a tracheotomy tent and giving antispasmodic or an anæsthetic. If the child is steadily getting worse, tracheotomy should be performed. The tube may be removed usually on the third to eighth day. Scarification is often recommended, but is more easy to write about than to perform.

Foreign bodies often find their way into the air passages of children. A bead, or grain of maize, or a plum stone, or other foreign body is held

* E. J. Lindsay, *Lehrbuch f. Kinderheilk.* B. ix. H. 2, records 38 per cent. of successes for 'croup and diphtheria,' and most of the successes were in the second year of life; and Cherm., *Lehrb. f. Kinderheilk.* B. iv. H. 11, 12, has collected 495 successful cases under 4 years; the youngest cases are 6 weeks and 9 weeks respectively; the latter, however, was the post-mortem case.—*Boellmer's Klin. Woch.* 1866.

† *Edin. Med. Jour.* November 1858.

‡ *Guy's Reports*, 1862, and *Reynold's* in the same number.

in the child's mouth, and a sudden inspiration may cause it to pass into the larynx. The body may lodge in the upper opening of the larynx or in the rima, or may pass into the trachea or either bronchus, usually the right.

Parker records a case in which a caseous lymphatic gland distressed its way into and blocked the trachea.¹

If the body is in the larynx there will be dyspnoea and more or less loss of voice, with hoarse or ringing cough, and if in the trachea possibly a low rattling sound may be heard on listening over the front of the neck, indicating the movement of the body in the trachea. If the substance is lodged in the bronchus there will be impaired breath sounds, and possibly collapse of the lung on the same side.

If the history is clear, tracheotomy should at once be performed, as sudden asphyxia often comes on quite unexpectedly; hence, urgent symptoms should not be waited for. The opening in the trachea should be low, and the edges should be held apart to allow of the ready expansion of the body, which is often blown out at once. If this does not occur, the larynx should be searched, a probe being passed in from below and the finger made to explore the throat from the mouth. If the body is lodged below the opening, the child should be inverted and shaken, and if this is unsuccessful an attempt should be made to extract the substance with forceps or a brush passed down the trachea. Bronchitis and pneumonia usually speedily result if the foreign body is not removed.

Should the attempt at removal fail, if the body is in the larynx and cannot be pushed up into the mouth or removed from below, it is probably better to follow Holmes's advice and divide partially or wholly the thyroid cartilage so as to expose and remove the impacted mass; the operation is likely to do less harm than the retention of the foreign material. If the substance is lodged in the lungs, it may possibly be removed at a second attempt or may become loosened and coughed up; occasionally small bodies escape their way out and may even reach the surface of the chest. In other cases death results from pneumonia or pulmonary abscess.

Certain other conditions may demand tracheotomy in children—congenital syphilitic laryngitis, chronic simple laryngitis, papilloma, or, as already mentioned, pressure of pharyngeal abscesses.

Intubation of the larynx has been of late years practised by O'Dwyer, Waxman, and others, chiefly in America, as a substitute for tracheotomy. It has been urged in its favour that it is a less severe measure than that operation, and is likely to be permitted by friends when a cutting operation is refused; that it does not prevent opening the trachea later, should that become necessary, and that it is efficient, while it does not expose a raw surface to the diathermic poison nor allow unwarmed air to reach the lungs. A special set of instruments is required for this plan. From 20 to 30 per cent. of successful results have been obtained, but several drawbacks to its use are admitted, such as the difficulty of the manipulation, the liability to displacement of the tube, and its obstruction by membrane. Our experience of the operation has shown that a little practice is required to learn readily to introduce the tube; it is much more difficult to remove the tube from the larynx.

¹ *Brit. Med. Jour.* October 4, 1886.

² *Pide Winters, Brit. Med. Jour.* September 29, 1888.

Several improvements have been made in the apparatus, and the method has no doubt a considerable though limited field of usefulness. Intubation, as suggested by Symonds, is certainly useful in some cases where after tracheotomy there is a difficulty in getting rid of the tube.

In one instance in which we performed intubation upon a living child the result was disastrous; a portion of the membrane was pushed down before the tube, and the child instantly choked: it was only by immediate tracheotomy and the use of artificial respiration that breathing was restored.



FIG. 25.—O'Dwyer's Intubation Apparatus. The figure shows the 'introducer' with a tube fitted on. A separate tube is also shown.

Others have had similar experience. We have had some experience of the method in various forms of laryngeal obstruction, and have not been led to take a very favourable view of its suitability for cases of diphtheria where false membrane in any quantity is present. Of eleven cases of intubation under our care, in three success followed, in three tracheotomy was subsequently successfully performed, and in four instances the children died in spite of tracheotomy. The operation appears best adapted for cases



FIG. 26.—O'Dwyer's Extractor. The jointed hook fits over the tube and holds it firmly when the lever is depressed by the thumb of the operator.

where there is little or no false membrane—i.e. certain types of acute laryngitis, the less severe forms of diphtheria, where tracheotomy is for any reason undesirable, and for use in cases where mechanical obstruction remains after tracheotomy, or results from cicatricial contraction in the

¹ For further details we must refer to the *Medical Chronicle* for 1887, where abstracts of numerous papers on the subject will be found; also to the *Annals of Pediatrics*, 1887, and Wiegman's paper already referred to, and to the Appendix of the present work; also to Hall's treatise on Intubation, and Nonheup, *Brit. Med. Jour.* December 19, 1892.

larynx. It is certainly advisable for bronchitic and pneumonic patients. Recently a special pattern of short wide tubes has been used for cases where there is much loose membrane or discharge.¹

Lovett,² from a study of 838 cases operated upon at the Boston City Hospital either by tracheotomy or intubation, concludes: 'In general I would be glad to advocate the performance of tracheotomy instead of intubation in most cases of severe laryngeal diphtheria, except in the case of children under two years, when intubation is to be performed.'

The apparatus used for intubation, and figured above, consists of a special tube with an 'introducer' and 'extractor'. The child should be swathed in a blanket and held upright in the nurse's arms. The mouth is held open by a gag, a tube of proper size selected, threaded, and its pilot screwed on to the introducer; the left forefinger passed to the back of the throat pulls forward the epiglottis and serves as guide to the tube. Any difficulty in introducing the tube may, we have found, be got over by waiting for an inspiratory effort on the part of the patient and then slipping in the tube: this is a little practical point of much value. As soon as the tube is in the larynx the introducer is withdrawn with the pilot, and if the tube is in position the thread may be also withdrawn. We are of opinion that it is, however, much better to leave the thread in the tube to facilitate extraction; usually it sets up little or no irritation. The tube is then left in position for a time varying from a few hours to two or three days, according to the circumstances of the case. If left too long it may cause closure of the larynx or trachea.³ To remove it an anæsthetic may or may not be given, the extractor is introduced into the opening of the tube, which is then withdrawn. If too small a tube is used, it may slip into the trachea. Without practice the tube is apt to be passed into the œsophagus.

After the introduction of the tube, relief, though not necessarily immediate, is usually speedy. There is sometimes difficulty in feeding, from a tendency for fluids to pass into the trachea. If this difficulty occurs it can be met by feeding the child with its head hanging far back or by giving semi-solid food.

Chronic Laryngitis.—Both infants and older children suffer from chronic hoarseness, with occasionally acute or subacute exacerbations, with many symptoms. Such cases may take their origin in a past attack or attacks of subacute laryngitis, a certain amount of thickening being left behind. Other cases are apparently syphilitic, especially in infants. Tubercular laryngitis may also occur, but it is certainly uncommon. The larynx is also sometimes affected in cases of chronic pharyngitis where the tonsils are enlarged and perhaps post-nasal growths also exist. If the symptoms do not yield to antiseptic applications or the use of caustics such as nitrate of silver, there may be so much progressive thickening and dyspœsia that tracheotomy may be required; this is, however, very rarely the case.

Papilloma of the larynx is a rare affection, consisting in one or more warty outgrowths from the neighbourhood of the true vocal cords. The symptoms are aphonia and usually intermittent but increasing dyspœsia.

¹ Numbreg, *Brit. Med. Jour.* (London) 27, 1891.

² *The Medical News*, August 27, 1892.

³ *Curr. Lancet*, March 26, 1891.

coming on without obvious cause. Where laryngoscopy is practicable, inspection shows the warty mass or masses usually about the anterior part of the glottis. Sudden obstruction of the aperture may result from spasm set up by impaction of a pendulous growth between the cords, or gradual asphyxia may come on. Three modes of treatment are possible—removal of the growths by endolaryngeal operation, a method applicable only to late childhood and adults; the second is tracheotomy, with or without an attempt to remove the growths from the tracheotomy wound; and the third is thyrotomy, with excision of the warts when fully exposed. The last plan, which is the simplest, is open to the objection that injury is likely to be done to the vocal cords and permanent aphonia may result. Several successful cases by Parker, Davies-Colley, and others, have, however, been recorded. On the whole, in this disease, it is probably best to perform thyrotomy.

In two cases lately under treatment at the Children's Hospital by our colleagues Dr. Hutton and Mr. Collier, and by ourselves, repeated operations were required both in the shape of thyrotomy and of scraping out the growths through the laryngeal aperture. The tendency to recurrence was very marked indeed, and more than once the windpipe had to be reopened to prevent suffocation after the children had appeared to be convalescent. In both cases it was found impossible to dispense with a tube. The growths sprang from all parts of the interior of the larynx and upper portion of the trachea. Hutton* points out that cases of spontaneous disappearance of these growths have been recorded after portions had been coughed up, also after tracheotomy without further operation, and after an attack of one of the exanthemata.

* *Hutton's Med. Cases*, vol. v. 346, 1891.

CHAPTER XII

DISEASES OF THE RESPIRATORY APPARATUS—*continued***Bronchitis and Catarrh**

CATARRH of the bronchial tubes is a common affection at all periods of life and in every social grade, but it is in early childhood that it is perhaps the most common, and it is at this period that it assumes the greatest importance from the diseases which are liable to follow in its train. In old age, when the lungs are damaged by emphysema, and the chest walls have lost their elasticity, bronchitis is apt to be a serious and often fatal disease; but not less so is it in the very young, in whom the chest walls are alike wanting in elasticity and rigidity, the bronchial tubes easily collapse, and the lungs very readily join in the inflammation. The greatest liability appears to occur during the first two years of life; certainly at this age it is most fatal. Exposure to cold is in a large number of cases the exciting cause; climatic influences are seen, especially in late autumn or early winter, in the large number of cases of chest affections which occur at this period. That the larger number of cases should occur among the lower and worst-housed class is only what is to be expected, inasmuch as the lives of the infants and children are spent either in the foul and stuffy atmosphere of an overcrowded and ill-ventilated house, or they are exposed, imperfectly clad, to all sorts of weather in the streets.

The predisposing causes are many: some children seem to inherit a tendency to bronchial attacks, and, in spite of the greatest care and the most constant 'coddling,' suffer every few months, perhaps for the whole of the winter, from bronchial catarrh or severe colds, which pass into bronchitis with the greatest readiness; dentition, rickets, measles, whooping cough, intestinal catarrh frequently play an important part in the production of a bronchitis. During the time that a tooth is being cut children seem very apt to suffer from catarrh, which in the winter affects the bronchial tubes and in summer the intestines. Pressure of the tooth on the gums seems to act *indirectly* in producing a catarrh, sometimes with more or less spasm, as the child becomes wheezy at night, sibilus being heard all over the chest, while in the morning it will be perfectly well. This may happen several nights in succession. Rickety children are specially prone to suffer from bronchial affections, and in them it is especially serious on account of the softness of the ribs, and the weakness of the muscles of respiration, resulting in deformed chests and collapsed lungs.

Symptoms and Course.—The attack is often preceded by a cold in the

head, the infant sweats, its nose runs, and it begins to cough. If the bronchial catarrh which follows is mild, and the catarrh does not extend beyond the trachea and large bronchi, the general symptoms are slight: there is no diarrhoea, no dyspnoea, only a troublesome cough, perhaps some wheezing during respiration and a slightly elevated temperature at night. In the more severe attacks, in which the smaller bronchial tubes are involved, their mucous membrane being swollen and the secretion thick and viscid, dyspnoea from obstruction to the air entering the lungs will be present. The pulse is hard and accelerated, the number of respirations increased according to the amount of obstruction, the abdomen swelling, the skin hot, and the infant restless and thirsty. On placing the ear to the chest, dry hissing or roaring sounds will be heard during inspiration, as the air rushes through the pulmonary divisions of the bronchi, in the severe cases entirely obscuring the respiratory murmur. In the milder attacks rhonchi will only be heard with some respiratory movements, being more especially heard at the roots of the lungs.

In infants and young children, especially if their ribs are softened in consequence of rickets, there is recession of the chest walls, chiefly at the epigastric and lower lateral region of the chest, due to the imperfect filling of the lungs, the chest wall falling in as place of the lungs expanding. In a later stage the sibilant or rhonchial sounds become mixed with moist rales: these are not distinctly and sharply crepitant, as of bubbles passing through thin fluid, but indistinct bubbling sounds as of air forced through thick tenacious mucus. The moist sounds succeeding the dry point to a free secretion of mucus from the hitherto swollen and congested mucous membrane. In some cases in infants mucous bubbling rales are heard from the first. If convalescence is quickly established, the abnormal sounds are gradually replaced by the normal respiratory murmur, though rhonchi or rales may be heard for some days or weeks. Percussion of the chest walls during an attack of uncomplicated bronchitis shows the resonance normal, although perhaps there may be some hyper-resonance at the sub-clavicular regions from the presence of more or less emphysema.

In most attacks of bronchitis there is usually more or less disturbance of the digestive organs. The bowels may be confined and distended with flatulence, the tongue is coated, and there is often more or less vomiting.

The fever in uncomplicated cases is never high: there may be an evening rise of a degree or two, while the morning temperature may be normal or subnormal, especially in weakly children. The cough, which in the early stages is hard, in the later stages becomes looser, mucus is coughed up into the pharynx and then quickly swallowed, unless extracted by means of the nurse's finger. Children under five years rarely expectorate—mucus is coughed up, but they have not the power to spit it out.

An attack of bronchitis usually lasts a week or ten days and ends in recovery, leaving the child subject to a second attack.

Complications.—Bronchitis in infants and young children is frequently accompanied by one or more complications, the commonest being collapse of the lung, catarrhal pneumonia, bronchiectasis, and emphysema. In a fatal case it is almost certain that one, or more often all four, of these complications will be found.

Collapse of Lung.—During an attack of bronchitis or bronchial catarrh it is not uncommon to note that the respiratory murmur is weak or absent over a portion of lung—as, for instance, one or other base; then perhaps after a vigorous cough a plug of mucus is dislodged from a large bronchus and the breath sounds, with perhaps some loose riles, are heard over the same area. At other times the breath sounds are absent, and by the next day the ordinary respiratory murmur will again be heard. In this case a plug of thick mucus lodged in one of the larger divisions of the pulmonary bronchi prevents the ingress and egress of the air from the lung, but is expelled and coughed up by an *accus* effort.

If, however, thick mucus is drawn into the smaller bronchi, perhaps filling up a series of small branches, the most powerful expiratory effort the child can make fails to clear the occluded bronchi, especially when the respiratory muscles are weak and the ribs are soft and easily bent. Two things are now certain to happen—the lung supplied by the occluded bronchi collapses and more or less dilatation of the bronchial tubes and emphysema of the neighbouring lung occurs, unless the chest walls fail in to take the room of the collapsed lung. The lung collapses in consequence of the absorption of the imprisoned air, the air entering the blood-vessels, as shown by the experiments of Lichtheim. It is clear that this collapse of lung and vesicular emphysema at least temporarily damages the lung, and if this should occur to any great extent in acute bronchitis, it adds considerably to the danger of death by asphyxia.

The symptoms to which collapse gives rise are not always very definite, and unless tolerably extensive there may be no sign of its presence. In some cases it may supervene suddenly, possibly by the sucking in of mucus which has accumulated in the trachea during sleep into the bronchial tubes, the dyspnoea becoming urgent, the child's lips blue; it rolls about in its on struggling for breath, and convulsions come on which perhaps pass fatal. In other cases, while the symptoms may be alarming for the time, they quickly pass away, a result due to the mucus being expelled. If the collapse is scattered in patches throughout the lung, especially if accompanied by emphysema, it will be impossible to detect it by any physical signs; there may be hyper-resonance due to the emphysema, weak breath sounds, and perhaps some moist riles. If any extent of lung is involved, as part of an apex or base, there will be some loss of resonance, but this is rarely well marked unless some broncho-pneumonia be associated with it, a pneumonic patch and a collapsed patch lying side by side. The respiratory murmur over the collapsed patch is weak, and there has at most scarcely any be heard. In some cases there appears to be a mixed condition of collapse with much congestion of the vessels and oedema, or possibly, as some authors believe, the collapsed lung becomes the seat of a low form of pneumonia, leucocytes and epithelial cells being present in the air sacs.

Bronchiectasis and Emphysema.—Dilatation of the bronchi frequently takes place during acute bronchitis, the walls of the medium-sized and small bronchi being thin and their calibre increased, a result no doubt due to inflammation softening of their walls. Emphysema is also constantly present in association with dilated bronchial tubes. The chest walls during an acute attack assume the position of rigidity, and, particularly the infradiaphragmatic

regions, become hyper-resonant, while the expiratory murmur is prolonged. As already remarked, compensatory emphysema is constantly present in association with broncho-pneumonia and collapse. Bronchiectasis takes place in association with chronic pleurisy and fibroid conditions of lung.

Chronic Bronchitis and Bronchiectasis

Children and infants, like adults, suffer from chronic bronchial catarrh; they recover slowly, and then perhaps within a few weeks another attack supervenes. Some children show such a tendency to these attacks that they have to be kept indoors almost all the winter, as exposure to even slight cold is sufficient to lay them by for weeks. Frequent and long-continued

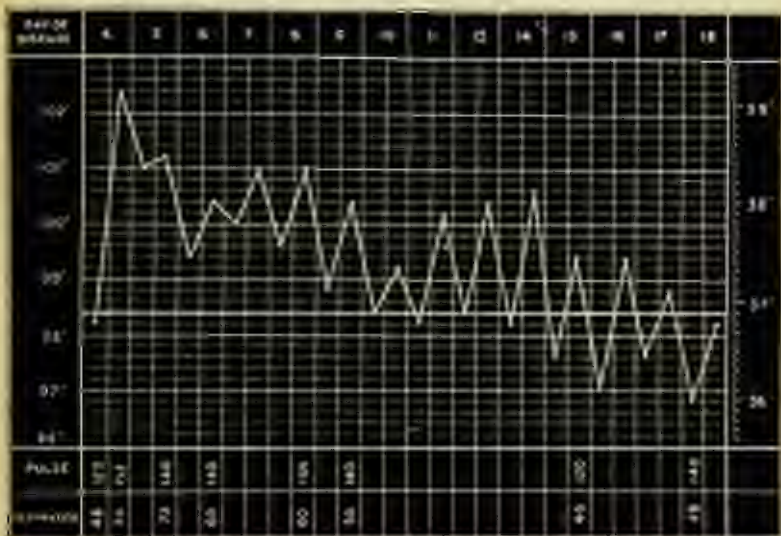


Fig. 15.—Temperature Chart of a case of Bronchitis with disseminated patches of Pneumonia.
Boy of 5 years. Recovery.

attacks of bronchitis are certain sooner or later to produce emphysema, dilated bronchial tubes, and dilatation of the right side of the heart and the veins which empty into it. Such children present a typical picture; they are mostly thin, with rounded drooping shoulders, barrel-shaped chests, enlarged superficial jugular veins and often injected capillaries on the cheeks. In some of these more or less dullness may be detected at one base or another, and they constantly cough up large quantities of very foetid mucus. Such cases are anything but welcome inmates in a ward, on account of their extremely foetid expectoration. They are very chronic and not much amenable to treatment. We have attempted external drainage of the dilated bronchial tube, but have not met with much success, as the patient has gradually sunk. In the milder cases such children with care improve greatly, and

frequently by puberty lose their tendency to bronchial troubles, and grow up, if not strong, at least not with impaired health. On the other hand, there is always the risk of an intercurrent and perhaps fatal pneumonia; we have seen children of this class with marked emphysema come regularly into hospital perhaps twice in a winter with attacks of creosote pneumonia. There is a risk of chronic bronchitis passing into a chronic broncho-pneumonia, the lung tissue around the dilated bronchi becoming caisson and indurated. There is also the risk of tuberculosis, but we have not often been able to trace a connection between chronic bronchitis and tubercle, though those suffering from chronic bronchitis are often mistaken for phthisical subjects.

Broncho-pneumonia.

In many cases the attack begins with a bronchial catarrh and quickly passes on into a broncho-pneumonia, the inflammation extending from the



Fig. 15.—Temperature Chart of a case of acute Broncho-pneumonia in a boy of 14 years, dated 15th Feb. 1905. At the first two or three hours of illness showed generalized broncho-pneumonia with "gravelly" sputum.

bronchi into the air-cells. In other cases the bronchial symptoms may be slight or absent, and the attack may closely resemble a creosote pneumonia. Between these two types all gradations may be met with. When the pneumonia supervenes on bronchitis, all the symptoms become exaggerated, the child is restless, the cough shorter and more hacking, the skin hot and dry, the evening temperature usually reaching 103° or 104° with morning remission.

sions of several degrees, so that the fever assumes a remittent type; sometimes there are evening instead of morning remissions, the temperature being at its lowest in the evening; the dyspnoea is usually great, the respirations numbering forty or fifty, but varying with the amount of fever and extent of lung involved. If the pneumonia is extensive, the face wears a distressed expression, the air not work vigorously, the child lies weak and helpless in its mother's arms, too feeble to cry, or if it resists examination for a while it is soon exhausted and passively submits.

An examination of the chest, if made when the attack is fully developed and severe, shows that the accessory muscles of respiration are brought into play, the respirations are rapid and shallow, with recession of the epigastrium and intercostal spaces. The percussion note varies according to the position of the consolidated lung; this may involve an extended portion at one or both bases, at an apex, or be scattered in patches over the lungs. To detect the pneumonic portions both light and strong percussion should be practised, carefully comparing any spot where the resonance appears impaired with the opposite side. There may be hyper-resonance, especially anteriorly, from the presence of emphysema. A considerable amount of pneumonia may exist if diffuse or patchy without any definitely impaired resonance. There is never complete dullness in pneumonic consolidation unless much lymph or some fluid be present. On auscultation *rhonchi* are usually heard over the chest, while over the pneumonic portions rales of a consonant or ringing character are heard, which contrast with the subcrepitant rales of a simple bronchitis, inasmuch as they are more intense, from the fact of their travelling to the ear through consolidated lung. Even though no consolidated lung can be detected by percussion, the presence of consonant intensely ringing rales with a temperature of 102° or 104° points almost certainly to pneumonia.

In the early stages the respiratory murmur is weak, later there is mostly well-marked bronchial breathing over the dull area. If a fatal result is about to occur, the respirations become more hurried, the distress greater, and the pulse weaker and weaker; *rhonchi* and *thoraxi* are heard over the whole chest, the heart flags, and the child becomes pallid and comatose, death taking place with symptoms of toxæmia on account of the bronchi becoming choked and the lungs consolidated. The temperature usually falls towards the close; the child is frequently convulsed. If, however, the attack takes a favourable turn, towards the end of the first week or earlier the temperature approaches normal, the breathing is easier, and the child, instead of concentrating his whole attention on himself, begins to notice those about and to play with his toys. The physical signs change but slowly, the bronchial breathing and rales being heard perhaps during the second or even the third week.

While the above is the description of a typical attack, the pneumonia may be of much less well-marked character. The child may seem ill with little or no cough, while there is loss of appetite, coated tongue, and feverishness, especially well marked during the afternoon or evening. An examination of the chest may at first yield no positive result, yet in a day it will be noted that there is a patch of lung at the extreme base, axilla, or near the root where the air does not enter well, and the respiratory murmur is replaced

by breathing of a distinctly bronchial character. In a few days or a week the temperature may again become normal.

Sometimes an attack of broncho-pneumonia closely simulates the croupous variety, and there may be a doubt as to which category to refer it. The onset may be sudden, accompanied by a convulsion or series of convulsions, the temperature may rise to 104° or 105° (see fig. 39), the physical signs may point to an extended portion of lung being involved, and only the course of

the attack, the temperature becoming intermittent, and reaching normal gradually by lysis, would seem to indicate that the attack is rather of the catarrhal than the croupous variety. Some cases may from first to last be open to doubt.

Course.—While broncho-pneumonia is frequently an acute disease, proving fatal in a few days or a week, its course in many cases is subacute or chronic, lasting for several weeks or even more and yet ending in apparently complete recovery. In some instances recovery takes place, to be followed by a relapse, the temperature again becoming resistant for a few days or a week. The termination of the fever is *strictly* always by lysis. In these protracted cases the possibility of tuberculosis or a local erysipela must always be borne in mind.

Secondary Pneumonias.—Pneumonias, mostly of the broncho-pneumonic form, occur as complications of many diseases, and may in consequence be modified in their course and in the symptoms they present. Thus a **miliary tuberculosis** may give rise to an acute broncho-pneumonia, which may run a short or protracted course, the two conditions present essentially modifying each other. In **whooping cough**, **measles**, **scarlet fever**, **diphtheria**,

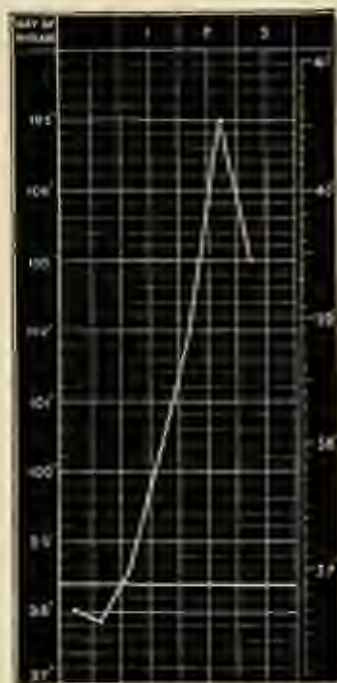


Fig. 39.—Temperature Chart of a case of acute lobular pneumonia in a patient of 4 months, almost unmodified case. The whole left lung except a small part of upper lobe, which was emphysematous, was solid; sections of lung not so solid as red hepatization; lobules distinct, some of a pink and others of a greyish colour.

eatoto fever, pneumonia may supervene caused by the specific micro-organism of the fever, or, in many cases at least, by the septic organisms present. While the pneumonia occurring in these diseases is usually of the broncho-pneumonic form, yet it is mostly fibrinous, and in the worst cases exhibits a tendency to pus formation, so that small purulent abscesses may be found *just* scarion. In some cases a true croupous pneumonia may occur. In diphtheria the pneumonia is often haemorrhagic, small patches of dark red extravasated blood being seen on section of the pneumonic lung.

In acute summer *diarrhoea* a pneumonia is very apt to be present and add to the gravity of the attack; in the *chronic intestinal catarrh* of infants the immediate cause of death is frequently an intercurrent attack of inflammation of the lungs.

Chronic Broncho-pneumonia.—Attacks of broncho-pneumonia are apt to become chronic in consequence of an imperfect clearing up of the lung and the resulting caseous degeneration. Catarrhal pneumonia following measles or whooping cough is very apt in an unhealthy child or one who inherits tubercular tendencies to take a subacute course: a base or, less often, an apex of a lung remains more or less dull, the breath sounds are bronchial, moist sounds are heard, and the evening temperature rises to 102° or 103° F., with night sweats and emaciation. This state of things may go on for weeks, and it may be impossible to say if the caseous changes are progressing or not. The risk in such cases is undoubtedly that, although the lung may clear up, the bronchial glands may become caseous, and a general tuberculous of the lung, or perhaps tubercular meningitis, follow. Most cases of chronic broncho-pneumonia originate either in recovery or tuberculosis, though in some instances they run a very chronic course resembling a chronic phthisis; and at the *post-mortem* dilated bronchi and caseous and fibroid changes are found, but no tubercle, at least no grey granulations. Such cases during life are mostly regarded as chronic or fibroid phthisis: they present in their later stages the signs of consolidation of a portion of lung at an apex or base, the chest wall is probably retracted, there are bronchial breathing, sharp ringing rales, and very foetid expectorations, which is coughed up in large quantities. They are thin, anæmic, not easily put out of health, have clubbed fingers and dilated right hearts. They are usually very chronic cases. At the *post-mortem* there are found dilated bronchi filled with thick, foet secretion, cheesy nodules around the bronchial tubes, much fibroid and indurated lung tissue, and emphysema. In some cases there is gangrene of the lung before death. Children liable to bronchitis, or who suffer from it in the chronic form, require to be warmly clothed and protected from cold. Residence in a warm climate and pure atmosphere during the winter, and at high altitudes during the summer, should be insisted on where possible. A warm house is necessary if they have to winter in this climate. Every means must be employed which will improve their general health. In the following case a chronic pneumonia was followed by acute meningitis.

Chronic Pneumonia. Acute Meningitis.—*Case 5.* aged 3 years. Child member of a tubercular family; has had acute pneumonia several times. She had acute pneumonia several weeks before admission, and was sent to the outside. Admitted July 7. There is dullness on the left side behind, extending from the spine of the scapula to the base; over this area there is weak bronchial breathing, and what is apparently rales crepitantes. Temperature 101° . No effusion; child well nourished, but pale. Temperature fell to normal during the next day or two. On July 13 the temperature suddenly rose to 104° F. Towards evening she began to vomit continuously; temperature rose to 105° F.; there were some preliminary twitchings, and then she was severely convulsed. The convulsions continued till early the next morning, when she died.

Post-mortem.—Left lobe solid; sinks in water; bronchomemous much purulent secretion, and other walls are thickened; masses of fibrous tissue in the lung, spreading from the root. Lung substance dark red, soft, and contains some small cavities full of pus, containing thick, almost cheesy, pus. No obvious tubercle anywhere. Brain, arachnoid everywhere closely beneath it there is a mass of fluid of a cloudy yellow tint.

Sylvia fusca are marked with non-purulent lymph. Those of least much deeply swelling beneath endothel. No tubercle anywhere.

Prognosis.—Broncho-pneumonia is always a dangerous disease, but more especially so in children under 2 years of age who are rickety or scrofulous. The prognosis is necessarily serious if the pneumonia follow any other disease, as measles, whooping cough, or summer diarrhoea, or when it occurs in scarlet fever through the extension of the inflammatory process in the throat. In any severe case the danger depends upon the amount of lung involved and the softness of the chest walls. It must also be remembered that a young child may struggle through the bronchial affection only to pass into a condition of atrophy—the result of a gastro-intestinal catarrh. Both high and also very low temperatures are indicative of danger. The pneumonia may become chronic and tuberculous suppurative.

Morbid Anatomy.—The appearances seen *post mortem* in the bodies of children dying of bronchitis and broncho-pneumonia are very various, and are apt to puzzle those unaccustomed to the autopsies made in children; and much confusion has existed in the past in reference to them, especially in confounding the various forms of pneumonia and consolidation of the lung with collapse. Collapse of the lung is mostly patchy in its distribution, rarely affecting any continuous extent of lung or involving the whole thickness of a lung. It affects the anterior and inferior edges of the lungs, especially the anterior edge of the middle lobe of the right side and tongue of the left which covers the heart; it is sometimes present along the posterior border of the lung; the collapsed portions are depressed below the surface, purple in colour, and airless. Taken between the finger and thumb, there is no substance to be felt as in pneumonia. The collapsed portions can be inflated through the bronchi. The collapse is brought about in at least two ways—either from occlusion of a small bronchus by thick mucus, the air being first impounded and then absorbed by the capillaries, or by feeble inspiratory power aided by obstruction to the entrance of air, especially when the ribs are soft, as in rickets; in this case the chest fills in during inspiration, instead of the lungs becoming distended; it is in this way that collapse is produced along the anterior edges of the lung. The collapsed portions become indurated from the stagnation of the circulation; according to some, they become gangrenous.

What happens in the collapsed portions of lung in the long run is not clear. In most cases, apparently, recovery takes place; but we believe in some cases fibrin changes are set up, as evidenced by those chronic cases of bronchitis and dilated tubes, the latter surrounded by indurated lung. Acute emphysema plays an important part in the acute lung disease of children. It is sometimes produced very rapidly; thus, a child may die of acute broncho-pneumonia complicating measles in three or four days, and extensive emphysema may be present, no doubt produced during the period, and contributing very materially to the fatal result (see p. 277). The bases of the lungs are in an early stage of pneumonia and collapse, the upper lobes are overworked, the constant coughing consequent on the acute bronchitis produces emphysema, and the only remaining normal lung is thus damaged, and a fatal result quickly ensues.

The chief types found may be described shortly in the following groups:

1. **Acute Bronchitis involving the Smaller Tubes, Collapse or Lung-Vicarious Emphysema.**—On opening the chest the lungs are found to be in a condition of deep inspiration; these surfaces are studded over with clusters of lobules which are depressed and purple in colour (collapse), and with raised portions which are of a pale pink colour (emphysema). On section, thick semi-purulent frothy mucus exudes from the large and small bronchi; the latter sometimes contain a semi-membranous coagulum. The cut surface of the lung exudes much blood-stained frothy fluid, due to congestion of the lung; the lungs are crepitant, except where collapse has taken place. The large veins and right heart are much engorged.

2. **Disseminated Broncho-pneumonia.**—The bronchial tubes contain much frothy fluid, one or both lungs, especially the lower lobes posteriorly, have a semi-solid feel, but crepitate, and perhaps some nodules of various sizes may be felt. The section exudes much serum, purulent mucus exudes from the small bronchi, the cut surface of the lung has a mottled appearance, caused by clusters of lobules, which are grey or pale pink and have a firm feel, and bright red portions of crepitant lung. The paler portions are pneumonic and solid; the red portions are air-containing congested lung, which surround the pneumonic portions. Portions of lung which are removed will float in water, but easily break down on thrusting in the finger. The upper lobes are emphysematous.

3. **Acute Generalised Broncho-pneumonia, Pleurisy.**—The posterior inferior or whole of one or both lobes has a semi-solid feel, though less solid than in chronic pneumonia, with but little or no sense of crepitation. The surface is purplish in colour; the pleural covering may have minute haemorrhages on its surface, or be roughened from the presence of lymph. The cut section has a solid feel, yet it is not granular as in true chronic pneumonia, but easily breaks down on pressure with the finger, and sinks in water. It has a mottled appearance, in consequence of the lobules surrounding the terminal bronchi being paler in colour and in a later stage of consolidation than the intervening portions of lung. There will probably be collapse of the anterior and inferior edges, as well as acute emphysema in the same positions; some of the vesicles are frequently distended to the size of millet seeds, or even peas, and perhaps one here and there is ruptured. In a still later stage, especially if the inflammation is intense, as in measles or scarlet fever, a lobe may be solid, and on the surface beneath the pleura there are a number of yellow spots, the size of millet seeds or larger, which on pricking yield a drop of thick pus. On section, these yellow spots are seen scattered through the lung; they are the 'grains jaunes,' or 'abcès péri-bronchique,' of French authors, and are, in fact, minute abscesses surrounding the terminal bronchioles, formed by the softening of the pneumonic lobules. Pus mixed with lymph or serum may be present; when the pneumonia is double the temperature usually runs high.

The following case illustrates this form of pneumonia:

Acute Double Pneumonia, Myocarditis, Impaction of Meckel's Intestine.—John H., aged 24 months; admitted April 26, 1894. His mother states he has been a healthy child up to the present illness. A fortnight ago he became ill with cough and fever. Breathing has been very bad at night. He remains febrile. He is fairly well nourished; his head is somewhat retracted, and muscles of the neck are rigid. The right apex is flat.

and the base behind are very dull; bronchial breathing and sharp crepitation are heard over this area. On the left side there are rales, but no dullness; 12 of chest scars were withdrawn from the right side behind. Temperature 102° . Vomits constantly. April 27.—General condition, mostly right-sided; marked rigidity of the neck; vomits constantly. Well-marked *hæmoptoe*. April 28.—Very short breathing; dullness well marked at the left base as well as the right. Oxygen given. Temperature 100° . Graduated lute. April 29.—Marked relaxation of the neck; constant vomiting. Temperature 102° . April 30.—Temperature 102.4° twice during the day. Dead May 1.

Post-mortem.—Right pleural cavity contains 1½ of yellow serum, and lymph coating the lower lobe, which is partly compressed and partly solid; upper lobe solid at the base, showing broncho-pneumonia and *emphysema* in front; lower lobe, bright air surface, pneumonia in centre. Much clear fluid escaped from surface of the lungs and lower ventricles; no lymph anywhere. Stomach cloudy; veins full. It was suggested that the effect had something complicating the pneumonia, but this was not borne out by the autopsy.

4. In *infants under a month* a form of pneumonia is sometimes found which does not agree with the above description. A lobe, generally one of the lower, is semi-solid, its surface depressed and purple, surrounded, perhaps, by raised emphysematous vesicles. The cut surface is smooth and of a uniform plain colour, the lobules indistinct and airless, but the lung has not the solid feel of red hepatization.

5. In some cases *nodules of fibrinous pneumonia* as large as hazel nuts or walnuts, hard, and with a granular surface, may be found. We have seen this condition in connection with measles.

It has already been remarked that clinically broncho-pneumonia sometimes so closely simulates *crispous pneumonia* that it is difficult to say in which variety it is to be referred. The same difficulty may occur in the *post-mortem* room, as some lobular pneumonias have almost the solid feel found in *crispous pneumonia*, and a microscopic examination shows the air vesicles to contain fibrin, and yet the section, to the naked eye, is as granular as it is in red hepatization, but mottled, the clusters of lobules varying in size, and more closely resembling in appearance the condition of broncho-pneumonia.

The *micro-organisms* present in the broncho-pneumonia occurring in children have been studied by recent observers, more especially by Neumann,¹ Quacqueri,² Sorbitt,³ and Prudden and Northrup. The commonest micro-organism found appears to be the Fräuskel-Weichmann diplococcus, much less often Friedländer's bacillus. In the septic pneumonias present in scarlet fever, measles, and diphtheria various micrococci—including *Staphylococcus pyogenus aureus* and *albus*, and *Streptococcus pyogenes*—are usually present.

In the present state of our knowledge it is unwise to lay too much stress on the presence of these organisms in the pneumonic lungs; but it seems exceedingly probable that there are several micro-organisms which, if the conditions are favourable, are capable of going rise to inflammation of the lungs.

Diagnosis.—A clinical distinction between the above conditions is often impossible, inasmuch as bronchitis, collapse, emphysema, and catarrh

¹ *Laboratory Hygiene*, Band vii. p. 231.

² *Lac. cit.* Band vii. p. 475.

³ *Archiv f. Kinderh.* Band vii. p. 458.

pneumonia may all exist in the same lung, and more or less mask one another. However, a few points may be emphasised. In simple bronchitis the temperature is rarely high, there is no impairment of resonance, and the moist sounds, if present, are indistinct and distant. In broncho-pneumonia the temperature is higher, usually there is impaired resonance, perhaps wheezy or bronchial breathing, and the moist sounds are clear, sharp, and ringing. The diagnosis of collapse is much more uncertain unless much lung is involved; then there are impaired resonance and weak and distant bronchial sounds.

In all cases of broncho-pneumonia we must bear in mind the possibility of some localised collection of pus being present over a dull patch, and also that the case may be one of *milary tubercle* as well as broncho-pneumonia.

Treatment.—The colds in the head and bronchial catarrhs of children call rather for careful hygiene than active treatment. Confinement to a well warmed and ventilated room or suite of rooms, as long as the symptoms of a cold are present or rales are heard in the chest, with a light, mostly fluid diet, will in many cases be all that is necessary. Merely to confine a child to the house and let it run about in cold passages and stand in draughts is useless, and likely to give rise to another cold before the first has completely passed away. Some children are exceedingly liable to take cold, and bronchitis follows very readily, and with these extra care must be taken, and the last trace of a cold must have disappeared before they are permitted to go out. In those cases where there is a laryngeal or tracheal catarrh the cough is often troublesome, especially keeping the patient awake at night and disturbing the whole household. Among the household remedies for coughs which are useful are black currant jelly, glycerine lozenges, liquorice, and nubes simple or medicated. A cup of hot beef tea or cocoa the last thing at night will often soothe a troublesome cough. In many cases it will be necessary to give small doses of some sedative, especially in the case of older children. Morphine, codeia, acetate, hyoscyamus, tincture of ammonium, may be given for this purpose, made up in the form of a linctus with syrup of orange or telf. or glycerine. The morphine and hyoscyamus lozenges of the B.P. made with fruit juice or glycerine jelly are very convenient. Codeia jelly acts exceedingly well in soothing irritable coughs.

The diet should consist largely of fluids, milk, beef tea, light puddings, Lemonade, barley water, linseed tea, or asparagus throat and tend to produce free action of the kidneys and skin, are likely to be useful; salines such as citrate of ammonia or potash, or liq. ammon. acet., may also be given.

The prevention of attacks of bronchial catarrh and colds is a matter of much importance, especially in the case of those who are liable to bronchitis or asthmatic attacks whenever they take cold. A house in a dry and heating situation, with well warmed living rooms, passages, and bedrooms—while the ventilation and sanitation are carefully looked after—is a first necessity in the prevention of colds. Care must be taken that such children are properly clothed with well-fitting woollen under-garments, that they have plenty of exercise in the open air whenever the weather is suitable, while cold sponging or the tepid douche in the morning whilst standing in warm water is of much service in promoting the circulation in the skin and preventing chills.

Are 'colds in the head' infectious? It is a common experience that

almost a whole household is affected at the same time or in succession, and there can be little doubt that in some cases a nasal catarrh passes from one child to another without the latter having been exposed to any chill. Only occasional frothing attacks may be present, but of these next to nothing is known. Possibly a chill may predispose the mucous membrane to take on inflammation or become a suitable nidus for the cultivation of bacilli or other organisms present in the atmosphere.

If the catarrh passes downwards from the trachea into the smaller tubes, and the child in consequence 'whoops' and rhonchi are heard all over the chest, the child should be confined to his bed or cot, care being taken to have it warmly clothed and in a situation free from draughts. In the more severe cases of bronchitis and catarrhal pneumonia, especially in small children, a sort of tent should be rigged over the cot, or over or two clothes screens placed around with sheets hung on them so as to form sides and a roof will answer very well. The atmosphere must be kept moist by means of a brimstone kettle, or the sheets which form the walls of the tent may be kept moist. The temperature in the cot should be maintained at 65°-70° night and day. The diet should consist entirely of fluids if the attack is at all acute. Milk diluted with one-third or one-fourth part of whey, barley water, or soda water should form the principal food of nourishment; a cup of beef tea once or twice a day may be allowed. Moist, hot applications to the chest are soothing to the patient, and may be applied in the form of linseed poultices or fomentations. It must, however, be borne in mind that poultices made by unskilled hands may, especially in the case of infants and young children, do more harm than good; to surround the chest of an infant with a heavy poultice when the bronchial tubes are choked with thick mucus and patches of lung are in a state of collapse is simply to insure death by suffocation. The poultices should be well mixed, being not too heavy nor applied too hot (placing them against one's cheek is the best guide), carefully kept in position by means of a flannel binder, and renewed at least every four hours. A mustard poultice is often of great service in the early stage: one tablespoonful of mustard to four or five tablespoonfuls of linseed meal may be used, the poultice remaining on for three or four hours. This strength is not sufficient to produce more than some redness, and it can be renewed or replaced by a simple poultice according to circumstances. For infants and young children hot fomentations applied by means of spongio-piline or flannel are preferable to poultices: they are much more closely, and harm is less likely to be done by their application. Several layers of flannel may be used wrung out of water, or if need be moistened and water, and covered with a piece of oiled silk, the whole being surrounded by cotton wool. Poultices and hot applications are of most service in the early stages, when the mucous membrane is swollen and dry and the secretion scanty; in the later stages they are also useful if the secretion is thick and coughed up with difficulty.

In the early stage of bronchitis, if there is much whooping, dyspnoea, and distension, an emetic is of much service, more so, perhaps, in bronchitis than in catarrhal pneumonia. Pulv. opac. in 5-grain doses in syrup of orange peel may be given to a child under 2 years of age and repeated in a few minutes if it fail to act. The act of vomiting, especially after opacumina, will probably be attended by a freer secretion of mucus and relief to the

breathing. At this period the expectorant expectorants which appear to diminish tension in the vessels and thus relieve the congested mucous membrane are usually used. Of these antimony, ipecac., and arsenic are more frequently used than any others. In this stage, when the cough is hard and sibilus is heard in the chest, antimony in small repeated doses, short of producing nausea and depression, is of much service. (F. 23.)

In catarrhal pneumonia aconite in half-minim or minim doses is preferable. The drug may be continued for several days, as long as the fever lasts or the secretion remains scanty or is coughed up with difficulty. Given with caution and in small doses there is little fear of its producing too great depression; in feeble children, however, it may be well to give small doses of alcohol at the same time. Many prefer to give ipecac., or, instead of aconite, antimony, especially in the feeble and cachectic patients so often met within the out-patient room. Some believe ipecac. combined with alkalies such as bicarbonate of potash to be of especial value when mucous rales are heard in the chest, and the infant or child has much difficulty in coughing up the thick secretion which is formed. Simple salines are preferred by some. Dr. Lewis Smith recommends tr. acetat. viridis in half-minim or minim doses every second hour. As long as the cough remains hard, and the mucous secretion scanty or difficult to expel, the antimony or ipecac. should be persevered with, and is far more likely to be of service than the stimulating mixtures so often prescribed. It is when the catarrh continues, the cough becoming loose, the secretion liquid, and the fever is mostly gone, that carbonate of ammonia, squilla, and terrene are most likely to be useful. At this stage the fomentations and poultices should be given up in favor of a warm cotton-wool jacket, and stimulating applications may be applied to the chest walls. Ammonia may be usefully combined with digitalis and squilla, as in F. 24.

Stimulating applications to be rubbed into the chest-wall are useful in producing slight redness without being too severe. (F. 25, F. 26, F. 27.)

The *lin. potass. iodid.* & *vaporis B.P.* may be used in a similar way.

Iodide of potassium is often useful in the subsiding or chronic stage, and natic acid and *asa. foetida* are of much service during convalescence.

In bronchitis pure and simple the temperature is never so excessive as to require any antipyretic treatment, but in some cases of acute broncho-pneumonia, especially where it approaches the croupous type, or when it accompanies whooping cough or measles, the temperature is apt to take high flights. Sponging with tepid water, "packs," or when there is drowsiness or convulsions the warm bath gradually cooled down by adding cold water so as to reduce it to 60°, may be used. Phenacetin or antipyrin may be used for the same purpose with care, beginning with a small dose, 2 grains of the former for a child of 2 or 3 years of age. Both of these antipyretics have been used in small doses frequently repeated, in acute bronchitis and in broncho-pneumonia. An excessively high temperature, 104°-105°, is sometimes present in an early stage of pneumonia, accompanied by convulsions or coma; in such cases no time should be lost in resorting to baths or packs, while giving stimulants if necessary by the rectum.

Death usually threatens in bronchitis or broncho-pneumonia from mechanical interference with the air entering the lungs, asphyxia being pro-

daced, with great depression of the heart's action. This occurs, especially in young infants, by a blockage of the medium-sized and small tubes by thick mucus, which is difficult to expel, or is due to capillary obstruction, collapse of lung, acute emphysema, or a large tract of lung becoming involved in the pneumonic process. In young infants with obstructed bronchial tubes all tight binding up of the chest walls by poultices or bandages must be avoided; the position must be varied from time to time so as to give each lung full play in turn, and an occasional emetic of alum or opella will help to get rid of the excessive and tenacious secretion. The nurse's finger may be usefully employed in removing the secretion from the back of the throat after a fit of coughing. In suddenly produced dyspnoea either from collapse of lung or acute pneumonia, when the circulation through the lungs is obstructed and the right heart over-distended, local bleeding by means of a leech or two is often of the greatest service, and may be the means of saving life. One, two, or three leeches may be applied at the tip of the sternum, and after they fall off the bleeding may if necessary be encouraged by warm applications. Mustard baths, or rubbed frictions, or turpentine stripes applied to the chest, are likely to be useful in these cases where there is extensive pneumonia with much dyspnoea and cardiac depression—turpentine must be used cautiously. Arsenetta and digitalis must also be freely given under similar circumstances. Oxygen inhalation may be resorted to, but we cannot say that we have had much success with it.

The question of the administration of emetics, alcohol, and opium, is of importance. Emetics are mostly of value in the early stages of laryngitis or bronchitis when the cough is hard and the breathing difficult on account of the swollen condition of the mucous membrane; a free secretion follows the administration, and, moreover, the emptying of the stomach of the accumulated mucus and undigested food seems to have a good effect; ipecacuanha or sulphate of zinc answers best at this stage. Emetics are sometimes useful in a later stage of laryngitis and collapse when the bronchial tubes are choked with mucus, provided there is no pneumonia or cyanosis; 3*ss* to ʒi grains of alum in a teaspoonful of syrup of squilla is preferable to ipecac. or zinc at this time. Alum and honey may be given to infants on a small scale. Alcohol is unnecessary in the early stages, and it should always be used with caution in the later stages, for, like opium, it soothes the cough and in large quantities its effect is narcotic; it is therefore contra-indicated except in small doses if there is any tendency to cyanosis. Opium in the form of Dover's powder is often of great value if the child is restless and its cough irritable, but it is perhaps needless to say it should on no account be given if there is much dyspnoea due to the accumulation of mucus in the bronchial tubes or if much lung is involved.

During an acute attack of bronchitis or pneumonia the digestive organs are very apt to suffer; they may be vomiting, flatulence, and diarrhoea. This impaired digestion must always be borne in mind when the question of dieting is being discussed, and care must be taken not to overload the stomach and bowels with too large a quantity of milk, beef tea, &c. An occasional laxative dose of calomel or rhubarb and soda may be useful.

It is well to bear in mind the possibility that an infant may recover from an acute attack of bronchitis, to finally succumb to a gastro-intestinal atrophy dating from the acute bronchial attack.

Croupous Pneumonia

Croupous pneumonia in its typical form is a common disease in children over three years of age, and does not differ either in its course or morbid anatomy from the attacks in young adults, though the mortality is much less. Reference has already been made to the acute lobar pneumonias of infancy and childhood, which are frequently classed amongst the fibrinous or genuine croupous pneumonias on account of the extent of lung involved and also of their termination by crisis. That many of them are fibrinous to some extent is certain, as effused fibrin may be seen in sections prepared for the microscope, but in our experience such lungs when seen on the *post-mortem* table are more spongy and lack the complete solidity of the red hepatization of true croupous pneumonia, and the outlines of the lobules are readily seen in consequence of their differing from one another as to the extent to which they are affected. Moreover, while they may contain fibrin, the cellular element largely predominates. Fortunately it is of little practical moment under which division these pneumonias are classed: hybrid cases are certain to come under observation both in infancy and childhood, and we have frequently to be content with describing attacks as being of the 'croupous type,' or of the 'catarrhal' or 'broncho-pneumonic' type, according as their symptoms resemble typical attacks of either the one or the other. It is the difficulty of classifying hybrid cases that makes the statistics of one hospital or one year liable to error when compared with that of other hospitals or years.

The statistics (given below) of our own hospital of the cases entered as croupous pneumonia during the years 1878-1893 illustrate the comparative frequency of the disease at different ages. In this series of cases the total mortality amounted to 52 per cent., the highest being among children under 2 years of age.¹

Table showing the Ages and Mortality of 708 Cases of Croupous Pneumonia

Under 2 years		2 to 5 years		5 to 10 years		10 to 16 years		Total	Deaths
Total	Deaths	Total	Deaths	Total	Deaths	Total	Deaths		
29	8	215	20	338	8	126	1	708	38

The *etiology* of croupous pneumonia is not perhaps quite as simple as it seems at first sight. A schoolboy is exposed to a cold east wind after getting hot, or is chilled by a fall into water, and a few days later develops an acute pneumonia: in such cases there can be little doubt that pneumonia in some way or other is the result of a chill. In connection, however, with this, our own hospital statistics do not show much difference in the number of cases admitted during the different months of the year, though there is a

¹ These figures closely correspond with those given by Von Rauch: in 338 of his cases of croupous pneumonia in children under 10 years of age the mortality was 48 per cent.

slight preponderance in favour of March.¹ Attacks certainly occur at all times of year, in the warmer as well as in the colder months. On the other hand, it is quite certain that *croupous pneumonia* is at times epidemic and also infectious, affecting several members of the same household or the same street, and in a few instances there have been widespread epidemics, as, for instance, during the influenza epidemic of 1891. Epidemics of pneumonia associated with tonsillitis have occurred in schools and other large institutions where the sanitary arrangements have been found faulty. It may be taken for certain that while there is a form of pneumonia of the croupous type which follows a chill, it may be produced by other causes, such as infection by the inhalation of the Friedländer-Weichselbaum diplococcus or the *anthrax bacillus*, or it may be part of some general septic poisoning. In some instances acute pneumonia has followed injury, a blow on the chest or a fall on the head has been followed a few days later by a pneumonic attack.

It seems to us that it is more than probable that these micro-organisms are incapable of setting up pneumonia in healthy lung in a normal condition; but if the individual has caught cold or is in a low state of health a variable soil is produced, and if an infection takes place a pneumonia is the result.

The pneumonic diplococcus appears to be almost constantly present in the sputa of cases of croupous pneumonia in the early stage, but it is also found in the pus from an acute otitis and also in the effusion in croupous spinal meningitis. It has been found in the sputa of healthy children. It can hardly be said to be pathogenic of pneumonia, but it is apparently capable of setting up pneumonia under certain conditions.

In different epidemics, or in different years or localities, attacks of pneumonia appear to vary in their character, sometimes being of the *effusive*, sometimes of *anthrac* type; this has been specially described by Forssell.²

Symptoms and Course.—The onset is sudden, with symptoms not unlike those of scarlet fever: there is high fever, dyspnoea, rapid pulse, tenderness, pain in the side or abdomen, short cough, and perhaps vomiting and diarrhoea. In children under three years convulsions are not uncommon at the onset, but these are rare in older children. The convulsions may prove fatal before the attack of pneumonia has fully declared itself. Delirium may be an early symptom, especially if the fever is high. By the time a medical examination is made the child is usually too ill to be about, and is either in bed or being nursed in its mother's arms; the cheeks are flushed, the skin may be working, the respirations are perhaps doubled, being possibly 40 per minute or more, the pulse 120 to 140, there is a temperature of 104° or thereabouts, the tongue is dry and brown, and there may be herpes vesicles on the lips and nose. An examination of the urine shows it to be dark in colour, concentrated, containing albumen and an excess of uric acid, and deficient in chlorides. The cough is dry and hacking, and pain is often complained of during the act; in young children there is no expectoration, in older ones there may be the usual rusty sputa. The fever and dyspnoea continue, the child remaining very ill till the end of the week, when, usually between the

¹ In all cases of croupous pneumonia during the years 1895-1897, Deane found a slight excess in April and May.

² *Contributions*, July 1886.

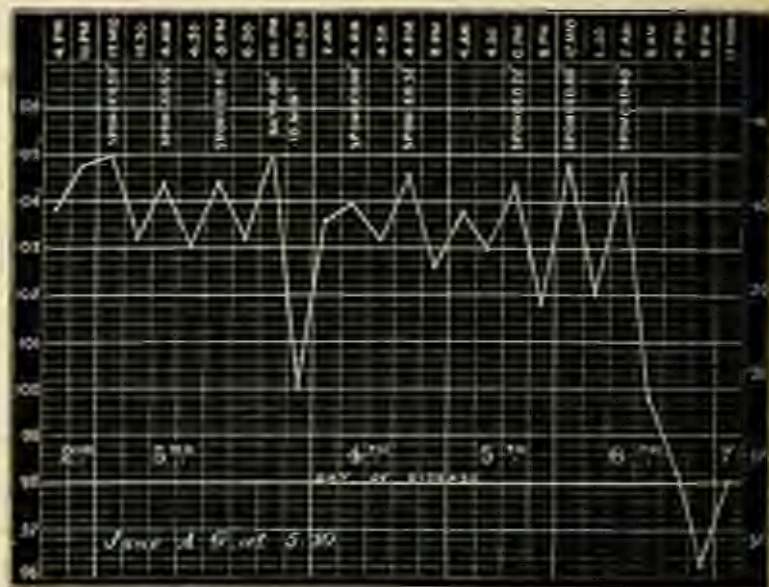
sixth and ninth day, the fever suddenly abates, and a marked improvement takes place in all the symptoms, so that it is evident to all that the crisis has come. The crisis is sometimes marked by collapse, the child becoming cold and clammy, with a subnormal temperature.

Physical Signs.—An examination of the chest on the first or second day of the attack will usually lead to the discovery of more or less consolidated lung. Careful percussion, striking now lightly, now more forcibly, will elicit a certain high-pitched note of impaired resonance over some part of the chest wall, as in the infra-clavicular, axillary, or scapular region, or over the root or base of the lung; on listening over the affected area some departure from the normal breath sounds will probably be heard. There may be simply weak or distant breathing, as if the air was not entering freely into some part of the lung; there may be distant or interior bronchial breathing, or various abnormal sounds, as a pleuritic rûle, rhœlus, or, more often, subcrepitant or loose ringing râles, the fine crepitation so common in adults being generally absent. There are usually increased vocal resonance and fremitus, though it is not always possible to elicit these signs unless the child cries. If there is much lung affected, loud or harsh breath sounds are heard over the non-affected lung, and care must be taken not to mistake these signs of an overworked, for those of an affected lung.

The position of the consolidation varies considerably and does not necessarily correspond to a lobe, but may occupy the whole extent of lung anteriorly or posteriorly; or the most marked signs may be first detected over the root of the lung behind or in the axilla. The left base and right apex are favorite spots to be attacked, but any part of the lung may be involved, though it must be borne in mind that the apices are more apt to be affected in children than in adults, and it is just at this spot that early signs are apt to be overlooked. In the course of a day or two, sometimes not far several, the physical signs become more marked, the dullness cannot be mistaken, the bronchial breathing becomes shrill and intense; in a few days more, usually after the crisis has arrived, coarse loose constant râles are heard which mark the resolution of the pneumonic lung. The dullness and bronchial breath sounds and râles disappear, but some want of resonance is apt to persist for many weeks, as the lung remains in an oedematous state. While such is the usual course of events in an ordinary case, there are marked differences with regard to the time when the physical signs make their appearance, there being frequently a delay of several days; they may even appear as late as the fifth day. It is important to remember this, for a mistake in diagnosis is easy, as a most careful examination of the whole chest may reveal nothing suggestive of pneumonia. In such cases there is a strong presumption that the pneumonia is centrally situated, perhaps at the root of the lung, and takes some time to approach the surface; or possibly there may be an acute inflammatory congestion of a portion of lung and a delay in the transudation of fibrin into the air sacs. Often a sub-tympanic or actually a tympanic note to percussion and weak bronchial breathing, or simply distant respiratory sounds, may be all there is to be heard for a day or two. It is not easy to say why a tympanic or "bossy" note is elicited over lung in a state of acute inflammatory congestion, or in the first stage of an acute lobar pneumonia, but that it does occur we have often had the opportunity

of observing. In a few cases the crisis may come and the child recover without the classical signs of pneumonia ever being present.

Temperature.—The temperature usually goes up suddenly at the onset to 104° or thereabouts, and during the course of the attack continues high, with slight evening remissions, till the crisis, when the fall is sudden (see fig. 31), perhaps 4° or 5° , to a subnormal temperature; the latter may last for a few days, and then the normal line be regained. The day on which the crisis takes place varies greatly: the attack may end about the fourth or fifth day or earlier, but usually the crisis is delayed till the seventh or eighth, and is the creeping form till the end of the second week or later: a post-crisis



pneumonia being developed; yet a careful examination of the lungs will discover some spot where the breath sounds are weak and the percussion note slightly raised or tympanic. Herpes is common on the lips and nose. (2) **Crawling or wandering Pneumonia** has been compared by Hensch to an attack of erysipelas spreading over the surface of the lung. The apex is perhaps the first part affected; gradually the inflammatory process spreads to the base, and possibly finally attacks the opposite side. Such cases are apt to have a chronic course, the crisis being delayed till the tenth or fourteenth day, or the temperature may fall by lysis, or a hectic may succeed in consequence of an empyema being present. (3) **Relapsing**



FIG. 34.—Temperature Chart of a case of Gross's Pneumonia of left lung in a girl of five years, treated by cold baths. Crisis fourth day; post-crisis fever. Recovery.

Pneumonia much resembles the crawling form. Several relapses occur after the crisis has come, some patch of pneumonia occurring in another part of the lung. We have known cases in which six or seven relapses have occurred. In such cases we may suspect pos. (4) **Cerebral Pneumonia**.—In this form cerebral symptoms are prominent, while in the early stages at least, the symptoms of pneumonia are latent; these may be convulsions, delirium, headache, and drowsiness. In such cases the fever usually runs high, and the cerebral symptoms may be due to the high fever and poisoned blood. Not infrequently the lesion in these cases is at the apex. Cough is often absent. (5) **Gastric Pneumonia**.—In these cases gastric symptoms are most marked; the attack may begin with vomiting, diarrhoea, coated

longer, fever, and abdominal pain, and it is only after a day or two, when the classical signs appear, that a diagnosis of pneumonia is made. The attack may simulate gastro-intestinal catarrh or peritonitis, the abdominal pain being due to diaphragmatic or costal pleurisy. (b) **Pleuro-pneumonia**.—In these cases the signs of pleurisy predominate; there is sharp stabbing pain, tenderness on percussion, and the child screams when it coughs or turns over in bed. Signs of consolidation are succeeded by those of pleuritic effusion, or an empyema possibly results.

Complications and Sequelæ.—**Pleurisy** frequently accompanies croupous pneumonia; percussion over the dull area and deep pressure give pain, and friction sounds are frequently heard; the pleurisy is apt to become suppurative in weakly children, especially if the pneumonia occurs in the course of scarlet fever, measles, or whooping cough (see *above*). **Pericarditis** sometimes occurs. **Hyperpyrexia**, a temperature of 104° or 105° occasionally taking place, accompanied by cerebral symptoms, convulsions in young children, or vapor and delirium in older ones. **Meningitis** is rare, though it occurs occasionally simultaneously with the pneumonia or follows as a sequelæ, being most common in young children. **Nephritis** also occurs in association with pneumonia; usually the latter is secondary to the former. **Jaundice** sometimes accompanies pneumonia, especially of the right base (see p. 231). **Gangrene of the lung** occasionally supervenes and brings about a fatal result; this seems mostly to occur either in pneumonia secondary to typhoid, or when pneumonia occurs in a subject who has emphysematous lungs. The possibility of the lung being adherent to the chest wall and undergoing an indurating or fibrous process must be kept in mind. A chronic condition of **caseation** may result, but this is much rarer than after catarrhal than after croupous pneumonia. **Diphtheria** of the fauces may complicate it; once or twice we have discovered, to our surprise, late in the attack or on the post-mortem table, false membrane on the fauces.

Prognosis.—The prognosis is favourable in cases of croupous pneumonia when it is primary and attacks healthy children over three years of age; among such the mortality is small. Double pneumonia is necessarily more fatal than single, but here the amount of lung involved at one time is not necessarily great, as usually while it is advancing on one side it is receding on the other; the danger depends on the amount of lung involved, and the respirations give a more or less useful indication of this. In a child who already suffers from chronic bronchitis and emphysema or cardiac disease, the prognosis is much worse. Secondary pneumonia, when it follows or complicates scarlet fever, measles, whooping cough, regimens, or follows operations or is connected with septicæmia, is necessarily a serious and often fatal disease. When much pleurisy accompanies the pneumonia, especially in young children, the prognosis is less favourable than in cases of simple croupous pneumonia.

Diagnosis.—In those cases of croupous pneumonia which begin with vomiting and high fever, and where the physical signs are delayed, there is a certain superficial resemblance to scarlet fever. That such cases are liable to be mistaken for scarlet fever is shown by the fact that not uncommonly cases of acute pneumonia are sent into fever hospitals certified as suffering from scarlet fever. A careful examination of the patient, and, if necessary, a

delay of twenty-four hours before coming to a decision, will, in the large majority of cases, prevent such an error. In the first twenty-four hours in a sharp attack of scarlet fever there may be high temperature, vomiting, diarrhoea, rapid pulse (often 150), tonsillitis more or less developed, no pain in the chest, or cough. The rash usually appears at the end of twenty-four hours. In acute pneumonia there may be high fever, headache, pain in the chest or abdomen, dyspnoea, pulse perhaps of 120, perhaps some physical signs in the chest, not often vomiting, diarrhoea, or sorellitis. There is no rash. Acute pneumonia with marked cerebral symptoms such as delirium, stupor, or headache, rashes on the teeth, and high fever may be taken for typhus. A careful examination of the lungs would generally decide; in typhus there may be evidence of bronchitis; in pneumonia there would usually be some want of resonance at an apex or base, with some distant or bronchial breathing. The presence of a characteristic rash on the third or fourth day would decide the diagnosis; it is well to remember that in children typhus is usually a mild disease. In young children an acute attack of croupous pneumonia, with high fever, convulsions, drowsiness, or coma, may be mistaken for acute meningitis, or, as a matter of fact, pneumonia and meningitis may co-exist. We should, however, hesitate in the presence of pneumonia and a temperature of 104° or 105° to diagnose meningitis, the cerebral symptoms being due to the high temperature and poisoned blood. In all cases where a young child is suddenly taken with convulsions and high fever, pneumonia should be suspected and a careful examination of the lungs made. We must remember that the temperature may be high, 102° or 103°, as the result of only a small patch of pneumonia. In such cases, especially in infants, the pneumonia may be overlooked and the temperature be ascribed to teething. The diagnosis between croupous pneumonia and generalised broncho-pneumonia may not be easy during life; we cannot often do more than say such and such an attack approaches more nearly to the croupous type, when there is a sudden onset, a local portion of lung involved, a continuous temperature, and a crisis; than it is more of the catarrhal type when there is *weak* bronchitis, an intermittent temperature, and gradual subsidence of the fever. The difficulty does not always end in the *post-mortem* view, as typical fibrinous pneumonia in patches or more widely distributed may be found in one lung and undoubted lobular pneumonia in the other, while both varieties may be present in the same lung.

Pathology.—In croupous pneumonia the first stage is that of an inflammatory engorgement of an extended portion of lung, the vessels are full, the capillaries are tumours and distended, encroaching on the air spaces in the lung; in the second stage the engorged vessels relieve themselves by pouring out liquor sanguinis and some corpuscular elements into the air sacs, which become blocked with fibrine, and a condensation of red hepatisation results. This red hepatisation, when seen at the *post-mortem*, differs from the lobular variety of catarrhal pneumonia in that it is more solid to the touch, and presents a uniformly coloured surface on which the outlines of the lobules cannot be distinguished; in children it is less often granular than it is in adults. In a later stage grey hepatisation is found, the lighter colour being due to the presence of a greater number of corpuscular elements. In lung in a state of red hepatisation, Frankel-Weichselbaum diplococci may be

usually detected by Gram's method. In one of our recent cases of fatal croupous pneumonia, in a boy of four years of age, who died on the eighth day (having been deeply jaundiced for three or four days), the left lung was in a condition of red and grey hepatization, except at the extreme apex. There were some localized hepatised patches in the right lung. We were able to obtain cultivations on glycerine agar of the Frinkel-W. diplococcus, *Staphylococcus pyog. aureus*, and *Streptococ. pyogenes*.

Treatment.—An uncomplicated case of croupous pneumonia in a child does not require active treatment, as the course is short, and the heart and arterial system, unlike the condition often found in adults, are free from degeneration, and able to stand the strain imposed upon them. The child should, of course, be confined to his bed in a well warmed and ventilated room; he should be allowed only fluid nourishment, such as milk, barley water, and soda water. A piece of sponge-pilule or flannel doubled several times may be wrung out of hot water, and applied to the chest. Fomentices may be used, and retain the heat better than anything else; but they are very liable to slip out of place, and are unsuited for infants on account of their weight. In the early stages acetate is of service, one or two drops of the solution being given every two or four hours, being watched carefully lest it produce too much depression. In many cases no other treatment is required, the acetate being stopped when the crisis comes. If the temperature is not excessive, not much exceeding 102° , no special methods of reducing it need be used, as the course of the fever is short, and often after the first day or two it takes a lower range: the initial fever in the case of infants and young children is in some cases high, and is, apparently, the cause of the cerebral symptoms, such as convulsions and coma, from which they suffer, and which sometimes prove fatal. When this is the case, no time should be lost in reducing temperature by cold sponging, packs, baths, an ice bag to the chest over the seat of the pneumonia, or by the administration of antipyretics. If the temperature is high— 104° or 105° —there is no need to fear any harm accruing from cold water, the simplest method of applying it being by sponging the patient over with cold water, or—what is more effectual—by a pack at 60° or 70° ; this latter can be applied by wringing a towel out of cold water, folding and applying it round the chest, or enveloping the whole body in a wetted sheet. The process may be repeated at intervals of an hour more or less. If these means prove inefficient, or if, as is the case of convulsions, there is no time to lose, the cold or graduated bath should be resorted to, the child being placed in a warm or lukewarm bath, and the temperature of the water gradually lowered to 60° F. by addition of cold water or ice; if the patient becomes blue and cold he should be removed at once.

The best antipyretics are quinine and antifebrin and phenacetin, either being given in two or three grain doses to a child of three years every four hours; antifebrin is apt to produce considerable depression, which, however, quickly passes away; large doses of quinine are apt to produce dyspepsia. The effects of acetate on the pulse should be carefully watched; any sign of intermission or irregularity should be the signal for omitting it, for a while at least, and substituting some simple saline, as liq. ammon. acct. or citrat; alcohol and stimulant expectorants are best avoided in the early stages; two or three drop doses of tr. digitalis, given every four hours, are often useful

if the pulse is poor; citrate of caffeine or sulphuric ether may also be given.

In cases where the case is delayed on account of the inflammatory process extending, as in the creeping form, and when the child seems low and weak, there is always a temptation to give emetics and stimulants, and these may in some cases be needed, especially in hospital patients who are seen for the first time after some days' illness; but our impression is that patients do better in the inflammatory stages, when the process is still extending, on small doses of acetate, ammoniac, or salines, than they do on a too stimulating treatment. An occasional dose of alcohol may do good when a continuous dosing is harmful; alcohol in large doses acts as a narcotic, and is apt to add to the drowsiness and tendency to delirium. Opium in the form of *sepiolite* or Dover's powder is of great value in calming the delirium and sleeplessness, as well as soothing the irritable cough and relieving pain when this is a marked feature, as it is in the pleuritic complications. One to three drops of *sepiolite* or half to two grains of Dover's powder may be given at night to procure rest and sleep. In double pneumonia, when there is much depression with a failing pulse, ether and digitalis must be resorted to. Ether may be injected in three or five drop doses discontinuously, or apothems and *m. digitalis* may be given every few hours. Champagne is a good restorative under these circumstances, but it may cause vomiting if given too freely, and it will be well to dilute it with soda water in the case of young children.

Gangrene of the Lung

Croupous pneumonia, when it attacks children already the subject of chronic bronchitis and emphysema, is apt to terminate in gangrene of the lung; this we have seen on several occasions. It is apt to follow pneumonia secondary to scarlatinal sepsis and also whooping cough. The principal diagnostic symptom is the exceedingly foul breath; the temperature is usually high, sometimes hectic, suggesting pus, and the pulse is rapid. The lung is found at the *post-mortem* in a state of grey hepatization, breaking down into ragged cavities and smelling offensively.

History of Lung.—*Hyperemesis.*—Joseph P., aged 3 years. Mother states he has been subject to bronchitis in the winter. On September 25 he came from school complaining of a pain in his side and bad cough. He has been spitting some blood. On admission, September 27, 1894, he is a thin, delicate-looking boy, with enlarged lungs. On examination of the chest: the right side has a heavy resonance at the base, behind which is dull; the breath sounds are very faint; some frothy sputum in the sputum; the left side is normal, except that the breath sounds are exaggerated. There is no marked depression, but he is subject to paroxysms of coughing, when he brings up considerable quantities of very fetid pus. October 2.—Paroxysms of coughing and foetid expectoration; some dullness at left base behind. Cutaneous temperature entirely on right side. Explored right side simultaneously in several different places, but failed to find pus. October 3.—Much collapse. Death October 5.

Post-mortem.—Right lung adherent to heart; in solitary region pyopneumothorax; pus very foul; cavity in middle of lobe, communicating with bronchus and also pleural cavity; patches of consolidation throughout the lung becoming gangrenous, in definite lobules. Left lung adherent behind; some pus in cavity. Heart and other organs show nothing unusual.

Abscess of the Lung

Purulent collections in the lungs are mostly the result of septic embolism from some distant suppurating centre, as in an abscess or some other bone lesion, and are associated with pyæmia. They are usually small and situated on the surface. Small abscesses may be secondary to an empyema, the latter finding its way out a small abscess into a bronchial tube. Minute abscesses are sometimes a sequæ of a broncho-pneumonia secondary to scarlet fever, measles, or whooping cough, suppuration taking place in the lobules immediately surrounding the terminal bronchioles; here small centres containing pus may be found (see p. 210).

In both gangrene and abscess of the lung, if the lesions are fairly localized, or the disease progressing, an attempt should be made to arrest the mischief by incising and draining the abscess or gangrenous cavity. For this purpose it is necessary to localize the abscess, first by the physical signs as far as may be, and, secondly, by exploration with an aspirator needle, though, if the evidence is otherwise strong, failure to draw off pus by the aspirator should not prevent a further exploration; the incision should be made over the abscess, and, if necessary, one or more segments of ribs removed; the lung should then be incised and drained, and treated on ordinary surgical principles. We have incised and drained a hydatid of the lung and a pulmonary abscess, with considerable relief to the children in each instance.

Pleurisy and Empyema

That pleurisy must be a common disease in children is shown by the frequency with which the lungs are found adherent to the chest walls when making autopsies on children who have died from various diseases. Here, as in the case of adults, the evidence of a past pleurisy is conclusive. Yet it cannot be said that pleurisy is diagnosed and treated with any great frequency during life, the reason no doubt being that young children are not able to localize attacks of pain, that when found it is not easy to thoroughly examine their chests by auscultation, and, moreover, the symptoms may be masked by other diseases in which the pleural lesion plays but a secondary part.

Pleurisy, primary and acute, occurs at all ages during infancy and childhood, the first year of life being by no means except. It is apt to follow exposure to cold or, not infrequently, an accident, such as a fall or blow on the chest. It is, however, far more commonly associated with a croupous, catarrhal, or septic pneumonia. It occurs very frequently in connection with tuberculosis of the lung.

Symptoms.—Pleurisy may begin suddenly and run an acute course, though more often it is insidious. The attack begins with a short cough, fever, shallow respiratory movements, the affected side moving less than its fellow, accompanied by sharp pain, which the child, if old enough to do so, refers to the side or very often the epigastrium. In infants the attack may be ushered in by convulsions and its course may be marked by screaming fits, especially if the child is disturbed. If the pleurisy is extensive and acute, an examination

of the chest shows the respirations to be shallow, and the movements of the affected side extremely limited, while percussion or pressure in the intercostal spaces with the finger gives rise to expressions of acute pain. On auscultation, while the breath sounds are loud and clear on the normal side, they are weak on the affected, and perhaps accompanied by a friction sound. The pulse is quickened and there is fever, perhaps 100° to 102°, unless pneumonia is present, when it is probably higher. The further course of the attack varies according to whether effusion of serum occurs or not. In the latter case, in the course of a few days the fever subsides, the friction sounds disappear, though perhaps some 'stitch' (stabbing pain in the side) remains for a while. In many cases apparently a local pleurisy takes place during the course of a bronchitis or bronchial catarrh in which little else than a sharp pain in the side or abdomen is present.

In pleurisy occurring between the diaphragm and lung the symptoms are generally obscure, there is pain and tenderness in the epigastric or hepatic region, with thoracic breathing, the abdominal vessels and diaphragm being kept as quiet as possible. Should effusion take place in any quantity, signs of its presence quickly appear. The child will probably lie on the affected side, so as to give full play to the lung on the sound side; the infant, as Henoch points out, with fluid in the right pleural cavity takes only the left breast of its mother for a similar reason. On inspection it will be noted that the side containing the effused fluid moves less freely than the other, and if the fluid is in the left chest, the cardiac impulse is displaced towards the right side. In large pleural effusions on the right side, the impulse may be moved towards the left. This displacement of the cardiac impulse is of special value in the diagnosis of fluid in the chest in children, on account of the uncertainty and small value of some of the other physical signs; as, for instance, the vocal resonance and fremitus, which yield valuable information in adults. The position of the heart's impulse is best ascertained by placing the surface of the hand on the chest wall, and, if necessary, by determining by auscultation the position of the heart by the comparative loudness of its sounds. It is necessary, however, to remember that the heart may be displaced without any fluid being present at the time of examination, as it may have been pushed on one side by a former effusion and have become fixed in an abnormal position by fibrous adhesions; in this case the lung also will probably be adherent, and a dull note may be elicited near it which suggests the presence of fluid. The heart may also be pulled on one side or upwards by a fibrous condition of lung or chronic pleurisy.

On percussion of the chest, a dull or much impaired resonance will be detected over the area occupied by fluid, while in most cases the sub-clavicular region and frequently also the supra-scapular fossa and possibly a strip between the base of the scapula and the spine will be resonant, often hyper-resonant. If the effusion is great the whole side will be completely dull and give a sense of resistance on percussion. On auscultation the breath sounds are weak and distant, but usually of a distinctly bronchial or tubular character. In the earlier stages of effusion the expiratory murmur is especially accentuated and bronchial, the air from the compressed lung being, as it were, expelled with difficulty. The breath sounds on the healthy side are unaltered. The vocal resonance and fremitus may be absent or

weak, but it may be impossible to elicit any information in this way, as the voices of children, especially girls, are weak, and moreover they may not be old enough to understand what they are wanted to do. During crying, information of value may sometimes be obtained by placing the hand on the chest. Comparative measurements of the two sides show the affected side in recent cases to be larger than the other; but too much value must not be attached to measurements, as in chronic cases some amount of retraction may have taken place. Of more value is the cyrometer tracing; this, as pointed out by Dr. S. Gee, shows a change of shape from the elliptical to the more circular form without the circumference necessarily being increased.

Should a large amount of fluid be poured out in a short space of time, it will necessarily give rise to dyspnoea: the child will turn over on to the affected side or lie upon its back; the *alae nasi* work, and the number of respirations is increased perhaps to forty or fifty. If the amount of fluid is smaller in quantity, the child may be tolerably comfortable while lying at rest, but there is dyspnoea on the slightest exertion. The amount of *leucocythæmia* varies; during the inflammatory stage before or during the period the serum is being poured out the temperature is usually raised two or three degrees; in the course of a few days a gradual fall takes place, and there may be no fever or only a slight elevation at night.

Under favourable circumstances in a healthy child, the serum effused begins to be reabsorbed: this it usually does in the course of a few days, the heart if displaced returning by degrees to its normal position, the level of the fluid becoming lower and lower, till the side regains its normal resonance; or, what is much more likely, a somewhat impaired resonance, which it retains for many weeks. The reason of this is doubtless that the re-expanded lung remains for some time in a sodden and congested state, and not improbably its pleural surface contracts adhesions with the chest wall. During the stage of reabsorption friction and *murmure râles* are frequently heard in the lung, and the breath sounds are weak. In some cases, however, this desirable reabsorption does not at once take place. The child's health is impaired, he is anæmic and depressed, perhaps thick layers of lymph are covering the pleural surface of the lung and chest wall, and conditions are not favourable for the reabsorption of the fluid after the inflammation has subsided; or possibly the absorption may go on extremely slowly, *pari passu* with the organising of the lymph which has been poured out. Under these circumstances much damage may be done, the heart may be fixed in a malposition, the lung may become tied down by a thick layer of fibrous tissue which contracting holds the lung in its grip, while the chest falls in and the spine becomes curved.

But besides a quick reabsorption of the serum, and a chronic pleurisy with its slow course, another result may follow, and that is—at least this is what is usually believed—the serum may become pus; this, however, is not a common result if the fluid effused is at first serum, and it rarely happens that it remains so for some weeks and then finally becomes converted into pus. An empyema, as a rule, is an empyema from the first, at least the fluid effused is turbid-looking at first; in other words, it is thin pus, and later it becomes thick pus. It is no doubt more common to find that where there is reason to believe fluid has existed in the chest for some weeks or months,

the fluid is pus and not serum, but then in all probability the fluid has been pus from the first and has failed to be absorbed, whereas had it been serum it would have been. Serum may undoubtedly remain in the chest undisturbed for many weeks, perhaps months; but this is uncommon except in cases of tubercle, or new growths in the lung, or in cardiac disease. An empyema is, in the vast majority of instances at any rate, the result rather of a pyro-pneumonia than a simple pleurisy. The more intense the inflammation the more likely it is that pus, not simple serum, is poured out, or that the serum poured out quickly becomes pus. This is especially likely to happen if a pyro-pneumonia follows scarlet fever, measles, or whooping cough, or indeed any pneumonia of the croupous type. The symptoms given by an empyema are by no means distinctive as between pus and serum, and often no definite diagnosis can be arrived at until an exploratory puncture

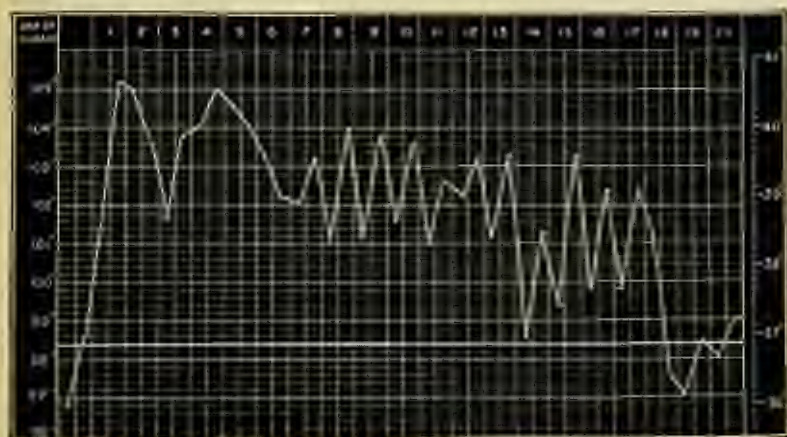


FIG. 120.—Temperature Chart of a case of Pyro-pneumonia followed by Empyema, in a girl of nine years. Signs of fluid were discovered on the sixth day; pus on the eleventh day; on the nineteenth day the chest was incised, followed by a fall in the temperature.

has been made. In favour of pus in acute cases would be the occurrence of pleurisy as a sequel of a systemic disease, especially in a weakly child; in chronic cases the presence of hectic, diarrhoea, a sallow earthy complexion, the 'pointing' of a collection of fluid in connection with the chest. A collection of purulent fluid may be present in the chest and give very few signs of its presence, except the physical signs. It must be remembered that in any chronic case of fluid in the chest in a child, that fluid is probably pus, but not universally so. The early history of an empyema is generally that of an acute pneumonia which does not clear up, and the presence of pus in the chest is likely to be thought to be consolidation of the lung, especially as there may be well-marked bronchial breathing. As an illustration of this the following case may be cited.

A girl of nine years was convalescent from scarlet fever. On the thirty-eighth day the temperature rose to 102°; there was almost pain referred to the left side of the chest and

epigastrum, especially felt when the patient is laid down on his stomach with all pressure at the left chest. On the third day of the attack there was diminished resonance over the whole left side, with bronchial breathing; no displacement of the heart. On the sixth day there was slight displacement of the heart to the right, the dullness over the left chest was much more marked, the breath sounds were faint and bronchial. On the eleventh day the signs of fluid had increased, the heart's impulse being felt at the left border of the sternum; an expiratory pressure showed the presence of pus. On the seventeenth day the chest was incised anteroposteriorly, pus and lymph lymph escaped, a tube was inserted, and complete recovery ensued (see fig. 51).

It must always be borne in mind if a purulent pneumonia does not clear up and the dullness disappear, or if the temperature really instead of falling when the time for a crisis comes, pus may be present in the chest. In such cases the signs of consolidation of lung are gradually replaced by those of fluid, the latter accumulating as the purulent consolidation disappears.

Pus may be present in the chest, yet not free in the pleural cavity, but confined by adhesion between the lung and chest wall or diaphragm. More than one localised empyema may be present on the same or opposite sides. Such localised collections may be present in any part, as at the apex or base, the base behind, or in front between the pericardium and anterior edge of the left lung, or between the lung and the diaphragm. These small empyemas are often associated with broncho-pneumonias and chronic tuberculosis of the lung. It is perfectly obvious that if these collections of fluid are not large and are surrounded by and backed up by crepitant lung, diagnosis will be by no means easy, and it is not surprising that such should be found on the *post-mortem* table, having escaped discovery during life. In these cases the physical signs are not distinctive; there will mostly be a patch of dullness, with more or less resistance, but an adherent lung with thick fibroid tissue between it and the chest wall will give a similar case. The breath sounds are weak, perhaps bronchial. When in doubt it is wise to explore, not using too fine a needle, as if the bore is too small it is apt to become blocked with a flake of lymph or pus. If the layer of pus is not thick the needle may pass through the pus into lung beyond.

Diagnosis.—The distinction between the consolidation of pneumonia and pleuritic effusion in typical cases is made readily enough. The intense bronchial breathing, with the clear, ringing rales and impaired resonance of pneumonic consolidation, form a marked contrast to the weak, distant breath sounds, wooden dullness, and displaced heart distinctive of a large effusion of fluid. In many cases, however, no diagnosis is possible without an expiratory pressure, and even then a negative result does not definitely settle the matter, as it is quite possible to miss the fluid. A pneumonic lung covered with a thick layer of lymph, or a swollen lung covered with fibroid tissue and adherent to the chest wall, gives a wooden dullness and resistance closely resembling that of fluid. On the other hand, when fluid is present the bronchial breathing is sometimes loud and even intense. A good rule to follow is, whenever there is a patch of dullness that does not clear up, especially where there is a hectic or elevated temperature, always to explore by means of a subcutaneous syringe. The diagnosis between a local or small collection of fluid at a base and chronic pneumonia, tuberculous pneumonia

and tubercular consolidation, is often far from easy, and indeed is generally impossible without exploration. There may be dullness and a febrile temperature, moreover there may be a patch of impaired resonance in the axilla while the apex and base are resonant, or both sides may be affected.

In one of our cases there was intense luncobial breathing and increased vocal resonance over the whole of the right lung, except at the base; it was very dull all over. We removed 7 oz. of pus and most cleared away afterwards.

Morbid Anatomy.—It is not often that an opportunity occurs of examining the chest of a child that has died of uncomplicated pleurisy or empyema, though it is common enough to find both in association with pneumonia or tubercula. The pleurisy differs much in degree, from a simply roughened surface to a layer of thick lymph; the adhesions which result from the organizing of the lymph also varying greatly in toughness and thickness. Serum in varying amount, perhaps in greater quantity than was absorbed during life, may be found in association with pneumonia, especially in such diseases as septicaemia, septicaemia, and scarlet fever. The lung corresponding to the position of the fluid is collapsed and airless. The result of a past pleurisy, especially when this has been chronic, is sometimes seen in the *post-mortem* in the shape of thick fibroid adhesions which completely surround and entangle the lung. The latter is completely adherent, airless, in a condition of cirrhosis, traversed by bands of fibroid tissue, and occupying a position at the posterior aspect of the chest in contact with the spine. In other cases there may be focal adhesions connecting both lungs with the chest wall and diaphragm, and on cutting through the lungs they appear to be riddled with cavities, which are in reality dilated bronchial tubes. The relation between empyema and tubercula is interesting and important. It is believed by some that the subjects of chronic empyema are apt to become tubercular; in other words, patients who suffer from a chronic empyema are likely to die of phthisis. We do not think, at least as far as our experience goes, that there is any *post-mortem* evidence to support this. That chronic pneumonia may terminate in tubercula by the mediastinal glands becoming cancerous is an almost every-day experience, but this certainly does not apply to empyema. Barlow and Parker, however, state that they have met with cases where they believed a tubercula was secondary to a chronic empyema. Localized collections of pus may sometimes be found in connection with chronic tubercula, but in these cases the pus is apparently secondary to the tubercular process.

Suppurative or simple pericarditis may take place by extension of the inflammation from the pleura.

Treatment.—In the early stages of dry pleurisy where the pain is severe the child is necessarily placed in bed, small doses of an anodyne being given and hot applications applied to the chest. Small doses of opiate relieve the pain best, such as Dover's powder or $\frac{1}{2}$ — $\frac{1}{4}$ grain of morphia given circumlocutiously; the latter may be administered to children over four years, but not to infants. Hot poultices may be used with less fear than in pneumonia where much lung is involved. Strapping the chest on the affected side with strips of belladonna plaster is often very useful.

† Dr. Harlan has also seen such cases.

The natural course of a *dry pleurisy* is towards recovery, the inflammatory condition of the pleura subsiding, the lymph effused being organized, and the lung becoming adherent to the chest wall. The adhesions thus formed differ very much in their firmness and strength, the lung being perhaps only *loosely* attached to the parietes, so that its movements are only slightly if at all impaired, or firmly attached by thick leathery adhesions, so that it cannot be torn away without damage. In the latter case the adhesions are extensive, the movements of the lung are impaired, it never properly empties itself of air, and it is in consequence always more or less in a congested or oedematous condition, and possibly becomes infiltrated with fibrous tissue while the bronchial tubes become dilated. Such cases are probably the result of *chronic or subacute pleurisy*; the chest may also contract and fall in. When an effusion of fluid has occurred, in the vast majority of cases *reabsorption* takes place after the inflammatory condition of the pleura has subsided, and the tension of blood in the vessels has become reduced to normal. Life, however, may be threatened from the excess of fluid thrown out; under these circumstances nearly the whole of the blood in the body is passing through the *soured lung*; it is consequently intensely congested, and may become *reëmatous*. Moreover, the right side of the heart is over-distended, and as a consequence sudden death is apt to occur. For this reason no time should be lost, if the dyspnoea and distress become great, in relieving the chest by the withdrawal of some of the effused fluid. On the other hand, the mere presence of fluid in the chest, if there are no signs of distress, does not necessitate operative interference, as in the great majority of cases absorption takes place in the course of a few days or a week. Operative interference, therefore, is called for in all cases where there is dyspnoea or orthopnoea when lying quietly in bed, or when there is much displacement of the heart. In those chronic cases where the fluid is not absorbed or is not diminishing in quantity after the lapse of a few weeks, the serum may be removed from the chest by means either of the aspirator or by trocar and cannula, the small ones introduced by Dr. Southey for the removal of the fluid in *ascites* answering very well. Whatever method is selected, the fluid should be removed slowly, and there is no necessity to remove all that can be aspirated. Too rapid aspiration of the fluid is apt to lead to bleeding into the chest from rupture of some of the capillary vessels, and may possibly cause *emphysema* of the lung on account of one part of the lung expanding faster than the other. On the whole, we believe the best results are obtained by the use of Southey's trocar and cannula. One of these may be introduced without difficulty and without pain if local *anæsthesia* be produced, a piece of fine india-rubber tube attached, and the fluid allowed slowly to drain away for a couple of hours or so, 10 to 20 ozs. being thus withdrawn; if necessary two cannulae can be inserted. In those cases where the dyspnoea is extreme, relief is more quickly obtained by aspiration. It may not improbably happen that the pleural cavity in part fills up again and a second or a third removal be required. In the less acute cases, where there is no urgency and no removal is attempted, the child should be confined to bed in a warm room and carefully protected from cold. It may be doubted if any drug materially aids the reabsorption of the effused fluid, though the usual treatment in such cases—namely, giving iodide of potassium internally and

painting liniment of iodine mixed with an equal quantity of glycerine externally—appears to be useful. The lin. iod. by itself requires using with care, especially in young or weakly children.

The natural course of an empyema differs from that of a simple serous effusion. In a minority of cases, especially when the empyema is small and confined by adhesions, it may dry up, and the imprisoned pus in time become craccaceous. But this event can hardly be expected, and should it take place, especially if the empyema be a large one, the result, accompanied as it is by contraction of the chest and compression of the lung, is anything but satisfactory. The presence of pus in the chest is inconsistent with good health, to say nothing of the risks the patients run of its burrowing in various directions. The child with a chronic undrained empyema probably suffers from hectic fever, is anæmic and sallow, the skin becomes rough, the fingers clubbed, and the child emaciates. Various other results may follow: the pus may find its way through the intercostals, and point in the fourth or fifth space, it may then gradually undermine the skin and a chronic discharge take place. It may open through the lung into a bronchial tube and be gradually coughed up; in this way recovery may eventually take place, though the process is a slow one; or an abscess or abscesses may form in the lung. An empyema on the right side may, either by contiguity or by opening through the diaphragm, give rise to an abscess in the liver. It may open into the abdomen by finding its way through the diaphragm, and set up peritonitis. The pus may burrow any distance, opening through the abdominal walls or discharging a fistular abscess.

Directly a diagnosis of pus in the chest is made, arrangements should be made to evacuate it, and this is the vast majority of cases should be by free incision and drainage. Aspiration may be tried once or twice in local empyemata, especially in infants and small children, but it is only in the minority of cases that it will succeed, as the cavity usually fills up again and separates the parts which should be kept in contact if a cure is to result.

The surgical treatment of suppuration within the pleural cavity is based on the ordinary principles guiding us in the management of abscesses elsewhere. Hence, although it occasionally happens that pleural abscesses dry up and do not discharge at all, or discharge through the lung or elsewhere and then heal, some of these possibilities should be looked for, and the treatment practically resolves itself into tapping and free incision.

Tapping an empyema with a simple trocar and allowing the fluid to drain away through a tube into an antiseptic lotion is a mode of treatment that is successful in certain cases, but is open to several objections. The cases for which it is suitable are those where the empyema is recent, of small size, contains no masses of lymph or caseous material, and where the lung is not bound down by firm adhesions but is ready to expand on removal of the compressing fluid; further, it is important for the successful employment of this plan that the pus be contained in one cavity only and not be localized. The dangers of tapping are the risk of wounding the lung by thrusting the trocar too far inwards on the one hand, and on the other the possibility of pushing the thickened pleura or a layer of lymph before the trocar so that the abscess cavity is not opened. There is also the likelihood of the cavity becoming blocked with lymph or caseous material, and of incomplete

emptying of the cavity because it is isolated or because the lung cannot re-expand.

Aspiration is open to the same objections, with the additional one that if too powerful suction is employed there is likely to be bleeding from the surface of the lung or the pleura, and the cavity may become partially filled with clot which readily decomposes.

The difficulty of emptying the cavity when the lung cannot re-expand has been met by Mr. B. W. Parker by the plan of injecting aseptic air into the pleura to replace the pus as it flows away, or kerosene may be used with the same object: but the plan has not met, and is not likely to meet, with general approval. Aspiration, then, should be employed for small, single, recent empyemata, and in some few of such cases after one or two tapplings the pus will cease to be secreted. Should there be chronic disease of the lung, cancerous material, glandular or other, or disease of the ribs or spine, since the source of irritation remains, pus formation will go on and aspiration cannot be sufficient. Failing, then, tapping or aspiration, the remaining resource is free incision and drainage of the abscess. The general plan of operation may be described first, and certain special points alluded to afterwards.

The incision should be an inch or more in length, and should be made along the lower margin of the space selected, so as to avoid injury to the intercostal vessels. The muscles should be gradually cut through until the pleura is reached, all bleeding being arrested before the pleura is opened. If the membrane is not much thickened, a sharp director may be thrust through it and used as a guide for the knife; if, however, it is very tough and thick, as may be the case if the disease is of long standing, it is better to incise it at once with the knife. As soon as the cavity is reached a pair of dressing or virus forceps should be passed in, opened, and the pus allowed to escape freely. The drainage tube is then to be inserted and secured by a thread round the chest unless a special tube is employed. Possibly the dressings will be soiled and require changing in a few hours; if, however, the cavity is fairly empty and thick wool-wool pads are employed, this is not likely to be the case.

The special points to be considered are the position of the incision, the drainage tube, the management of adhesions, and the washing out of the chest.

First, then, the position of the incision. Where the empyema is local the incision must of course be made over it, and the lowest convenient spot for drainage should be chosen. Where the whole pleural cavity is filled with pus a difference of opinion exists as to the most suitable spot for the opening. Mr. Marshall advocated an incision in the front of the chest, others prefer the axilla. We think, however, on the whole, the best place is just behind and below the angle of the scapula in the eighth interspace; this spot affords good drainage when the patient lies on his back or side, it is not quite so convenient for dressing, but it is nearly at the lowest point of the cavity, yet not so low as to risk injury to the diaphragm, which is liable to be drawn up to take the place of the shrunk lung.¹ Unless the incision is made too far back there is no great thickness of muscle to cut through.

¹ The objection that an empyema usually heals up at the back first, and thus therefore a cavity is likely to remain undrained in front, has not in our experience proved a valid objection to the posterior incision.

As to drainage, though in some cases when the chest is very full of fluid the intercostal spaces may be widened and bulging, yet much more often this is not so, and the ribs are so close together that it is difficult to get a tube into the chest, and when inserted it is liable to be ripped by pressure of the ribs. In such cases the ribs should be prised apart with dressing forceps, and a rigid tube, such as a silver or stainless tracheotomy tube, employed, or a piece of rib should be excised, which is a far better plan. The tube should not project far into the pleural cavity, but only just enough to be clear of the thickened pleura, otherwise it will fail to drain the cavity, and may be blocked by pressure against the lung. A double tube, or two pieces of tubing fixed together side by side (Battison's), are preferred by some surgeons: the plan is useful if it is intended to wash out the chest, but in many cases it is open to the objection given above.

After opening the chest a finger should be passed in if possible to ascertain the size of the cavity and to break down any adhesions shutting in localized collections of pus,¹ as well as to remove any masses of lymph or solid material in the cavity. If the pus is foul or thick and flaky, as large a tube as possible should be put in, and all solid and offensive matter carefully removed after resection of a portion of a rib. Should any bleeding occur from the intercostal vessels, they may be picked up or secured by a suture ligature passed round the rib including the vessel; this is easily done with an aneurism needle. Bleeding from the gasulating surface of the pleura after exploration soon ceases of itself, but all clots should be washed out.

During the operation careful watch must be kept by the anaesthetist that the child does not suffer from having to lie upon the sound side, and at any sign of falling pulse or respiration the child must be turned upon its back or towards the affected side. The after-treatment of empyema consists in keeping the cavity aseptic and well drained; obstruction of the tube is most likely to be due to flakes of lymph or to slipping of the tube if a rigid one is used, to ripping of the tube by the ribs if rubber is employed. As regards washing out the chest it must be remembered that there is a certain amount of danger in it; cases of sudden death during the process have several times been recorded, possibly from irritation of cardiac nerves in the wall of the cavity, or from sudden dyspnoea; this risk should deter us from washing out an empyema unless the discharge continues to be foul, and it should lead to caution and the avoidance of any distension of the cavity or the use of irritant lotions even in such cases. In free incision of the chest the opening is of course large enough to admit air readily, hence there is no obstacle to complete emptying of the cavity. The tube should not be left out until the discharge has nearly or quite ceased, and exploration with a probe has shown that the cavity is filled up; often, though there is but little discharge, a good-sized cavity or a long sinus remains, and if the external wound is allowed to close, fresh collections of pus will take place. In a certain number of cases the empyema will be pointing externally when the case is first seen; such pointing most commonly occurs in the front of the chest from the second to the fifth space, the matter sometimes pushing forward and pointing through the mammae. If the skin is already thinned the pus should be let out at this spot and the case managed as usual; if, however, the cavity does not drain freely, a

¹ Dr. Paget states that localization is very rarely found post mortem.

lung probe should be passed through the anterior orifice, and cut down upon at a more dependent spot, and a drainage tube inserted there. While admitting that the successful management of empyema is not simply a question of drainage as in other abscesses, we think a dependent opening is a highly important matter. A free outlet is absolutely essential.

Sometimes the pressure of the drainage tube causes absorption of one of the ribs; this is, however, a matter of little importance, since the rib usually regenerates after removal of the tube.

In a certain proportion of cases after drainage of the empyema the cavity does not become obliterated, but remains as a non-secreting sac; this is due

either to imperfect expansion of the lung or insufficient compensatory falling in of the chest wall. Under such conditions the discharge may go on indefinitely and cause lung cancer disease and hectic fever; it is then necessary to find other means of allowing the surfaces of the abscess sac to come together. For this purpose resection of one or more ribs (Eustlander's operation¹) has been devised. Although in children, from the softness and flexibility of the ribs and spine, the chest generally falls in readily, this is by no means always the case, and the operation should be done as soon as it is clear that progress is not being made or the child's health is failing. Where there is an insufficient opening for drainage, it is also necessary in some cases to provide a larger orifice by removal of part of a rib; and, indeed, it is a good practice to excise a portion of rib in all cases where the child is not so feeble as



FIG. 44.—Emphysema of Chest due to Empyema.

to make even this slight addition to the severity of the operation undesirable. The operation is a simple one; to remove a single rib, the lowest one in the cavity should be chosen, usually the seventh or eighth. An incision is made along it down to the bone, the periosteum is carefully peeled back with an elevator, and about an inch or more of the rib is cut out with bone forceps; the periosteum and pleura are then joined parallel with and avoiding the intercostal vessels; if the artery is wounded, however, it is easily secured now that the rib is gone. When the resection is done to allow collapse of the chest wall, from two to five ribs may have to be resected, two or three

¹ Eustlander's operation is strictly the removal of a sufficient part of the chest wall to allow of complete collapse.

inches of bone being taken from each; in such case a quadrilateral flap of the soft parts should be turned forward and the ribs removed one after the other. Though it is perhaps better in such cases to remove the bones subperiosteally, the periosteum should be cut away before closing the wound, otherwise it often happens that ossification rapidly takes place and fills up the gap in the chest wall and so prevents the desired collapse. We have sometimes found the intercostal vessels obliterated in these cases, and there has been no arterial bleeding at all. Marshall has divided the costal cartilages subcutaneously with the same object, but resection is the more complete operation, and it sounds and looks more formidable than it is. The subsequent management of the wound requires no description. Unless an empyema speedily recovers, more or less retraction of the side necessarily results, and from this a lateral or rather, as Lane has pointed out, a true retro-lateral curvature of the spine follows: this of course is largely inoperable, but some improvement may be obtained by treatment (*vide* LATERAL CURVATURE). (Fig. 34.)

Inasmuch as the ribs are less yielding near the angles, it is better to remove the bone as far back as possible up to the edge of the costal spine. We have tried osteotomy of the rib at the posterior part at the same time as resection to allow more complete falling in of the chest wall, but found little was to be gained by this means, since the rib is held firmly in place by the surrounding soft parts.

Asthma

Spasmodic asthma is by no means uncommon among children. Bronchial spasm is sometimes secondary to dentition: a child when cutting a tooth begins to wheeze, especially towards evening, and on placing the ear to the chest rales may be heard. A condition of asthma or urgent dyspnoea is frequently present in the uræmia of acutaltered nephritis and in the rare cases of contracted kidney which occur in children: it may be open to doubt if in such cases the origin is not cardiac, rather than due to any bronchial spasm. Hysterical children sometimes have attacks resembling asthma. The commonest form, however, is bronchial or spasmodic asthma, resembling the asthma of adults: these children are exceedingly liable to bronchial catarrh. In most of these cases this disease is hereditary, and may begin as early as two years of age. The attack begins with the symptoms of a cold in the head or a bronchial catarrh lasting for a few hours or days, then an attack of dyspnoea occurs, perhaps at night-time: the child sits up in bed and sighs for his breath, the breathing is quick, the air rare, the lips are blue: the attack lasts from a few minutes to an hour or two, and is followed by free secretion and relief. Some attacks are associated not with bronchial catarrh but with dyspepsia, and have been termed asthma dyspepticum by Hercock, the child having an asthmatic attack when suffering from dyspepsia or after taking indigestible food. Instances have occurred in which enlarged tonsils and post-nasal adenoids have appeared to have had a hand in producing such attacks. The treatment must be directed to prevent children from taking cold or becoming dyspeptic. Some high, heating, dry, inland site usually suits such children better than the seaside. The east winds of spring are especially liable to excite an attack. A house

uniformly warmed throughout, so that the child, who is necessarily confined much to the house, can wander from one room to another without the risk of cold, is a great advantage. An attack may usually be relieved by the burning of minute of porous papers, and by tobacco. Arsenic is the best remedy, with cod liver oil between the attacks. Iodide of potassium is also very useful. The bowels require attention; Carlsbad salts or some other saline purgative being useful for this purpose. Enlarged tonsils and post-nasal adenoids should be removed.

Diseases of the Bronchial Glands

The tracheo-bronchial glands are situated in the middle mediastinum in close relationship with the trachea and bronchi; they are some ten to twelve in number, and are arranged in three groups; one set surrounds the trachea, another group is situated at the bifurcation, and a third around the right and left bronchi. The pulmonary glands are situated at the root of the lung and accompany the bronchi into the substance of the lung. These glands receive the lymphatics of the lungs and bronchi, and like other lymphatic glands readily become inflamed and swollen during attacks of bronchitis and broncho-pneumonia, especially after measles and whooping cough, and are apt to remain chronically enlarged and farther to become **cancerous** and to **suppurate**. During this inflammatory process more or less thickening and matting often takes place in surrounding parts, so that the glands may become adherent to the trachea or bronchi or oesophagus. The glands and connective tissue in the anterior and posterior mediastinum may also become affected, so that the antero-internal edges of the lungs and the whole contents of the mediastinum may become thickened and matted together.

Casesion of the mediastinal glands is exceedingly common in children, and they may be found in this condition in the bodies of children dying of various diseases, but they are almost universally cancerous in those dying of pulmonary tuberculosis or chronic catarrhal pneumonia. In many cases of acute or chronic tuberculosis it is clear that the disease in the glands is older than the tubercle in the lungs, and has spread from the former to the latter. In such cases the glands have become enlarged secondarily to some bronchitis or pneumonia, have undergone caseation, and the lungs have been infected in consequence of caseating bronchial or pulmonary glands, the tubercular disease spreading into the lungs from the root.

Symptoms.—In the large majority of cases there are no distinctive symptoms of caseating mediastinal glands, and *per se* they are not very likely to give rise to symptoms than caseating glands in the neck; but, inasmuch as they are so frequently associated with early or chronic tuberculosis of the lungs, the subjects of them are hardly likely to present the appearances of health. Occasionally, however, they are found unsuspectedly in the bodies of children dying of other diseases. With regard to physical signs, it must be clear from a consideration of the anatomy of the mediastinum that the glands lie too deeply to be detected by percussion unless they are enormously enlarged; this may take place in sarcomatous enlargement, but rarely in tuberculosis. It has been asserted that when enlarged they can be detected by a

diminished resonance in the interscapular region, corresponding to the first three dorsal vertebrae; but, inasmuch as the thick posterior edges of the lungs, besides the aorta, oesophagus, and a mass of muscle, intervene between the glands and the surface, it is certain that the enlargement must be very considerable to modify the percussion note in this position. Enlarged glands are more likely to modify the resonance behind the upper part of the sternum and adjacent cartilages, but in infants and young children the anterior mediastinum is occupied by the thymus, which would mask any enlargement of the lymphatic glands; and in older children, where the thymus is small, lymphatic



Fig. 35.—Section through a large mass of lymphatic glands at the bifurcation of the trachea, and extending along the bronchi into the lung. Two of the glands are beginning to show signs of softening at their centers. (After M. J. Newbery, M.D.)

glands must be very much enlarged to come to the surface and give rise to any dullness, covered as they are by the anterior edges of the lungs. Error may easily arise from a dullness due to a past pleurisy and consequent adhesion along the anterior edges of the lungs. If the results of percussion are uncertain, those derived from auscultation are necessarily more so, except in considerable enlargement of glands. Of the pressure signs, the most reliable is weak breathing in one of the lungs in consequence of pressure on the right or left bronchus; this sign is of undoubted value, but as there is usually some tubercular lesion in the lungs, this symptom may readily be masked. Attacks of paroxysmal dyspnea, and cough with stridulous breathing, may also be

present on account of the nerves being involved. Swelling of the face and distension of the jugulars have also been described, but these are far more frequently due to constant coughing than to any pressure on the large veins in the chest. A calcareous gland not infrequently becomes adherent to the trachea or one of the bronchi, and ulcerates into it, and caseous matter may be coughed up; in a few instances it has happened that this takes place suddenly and death results from plugging of the windpipe. In other instances the glands may form an abscess which points in one of the intercostal spaces close to the sternum, as in a case under the care of Dr. Estabrook Smith, or may open into the oesophagus. In one of our own cases a **mediastinal abscess** pointed near the left edge of the sternum, low down.

The pulmonary glands which accompany the small bronchial glands in the lungs may become caseous, softer, and form cavities, more especially in the lower lobes. It must be acknowledged that caseous glands can rarely be diagnosed during life with anything like certainty, partly on account of their lying deeply, and partly from the fact that they are so commonly associated with chronic lung disease. They rarely attain any large size, and consequently do not modify the percussion note or press on the veins, bronchi, or nerves.

When, however, the mediastinal glands become the seat of a new growth, such as **lymphadenoma**, the case is different; they may become enormously enlarged surrounding the veins and bronchi, giving rise to marked distress over the sternum and adjoining rib cartilages, and pressure signs from involving the vessels. Attacks of paroxysmal breathing are common on account of pressure on the recurrent laryngeal and other nerves. The course of the disease usually extends over a few months only, the patient getting progressively worse. Among the early symptoms will usually be those of disturbed innervation. There are attacks of paroxysmal cough, with a metallic ring and asthmatic breathing and rales, so that the child has to be propped up to get its breath; in the later stages the distress is often very great. The voice is altered, perhaps reduced to a whisper. The return of blood to the chest may be interfered with on account of the superior vena cava being compressed, giving rise to a distension of the jugular or axillary veins and swelling of the face or arms. Fluid may be present in one or both pleural cavities from pressure on the azygos veins. If the tumour is of any size, there will be dullness over the sternum or in the adjoining region, particularly to the left edge of the sternum in the upper intercostal spaces. Intense bronchial breathing may be heard here. Moreover, the lung may be pushed to the left by the attachment of the tumour, which may bulge forward the sternum and ribs.

Chronic Tuberculosis of the Lungs

Infancy and Early Childhood.—No age is free from liability to be affected with tubercle; this Dennoe has found tubercular disease of the intestines in an infant of twenty-nine days.

Tubercular disease is not common in infants of a few months old; at this period gastro-intestinal atrophy is exceedingly common, and is liable to be mistaken for tubercular disease on account of the wasting which takes

place. Tuberculosis in young children rarely begins as does the phthisis of adults by a growth of tubercle and a condensation at the apices of the lungs, and a gradual extension downwards taking place, but is apt to be far more widespread in its distribution both in the lungs and in the body. It is therefore far more difficult to diagnose by means of physical signs which are less distinctive than are those of adults. It is needless to say that the same general appearances are found in the bodies of children as in adults dying of tuberculosis—grey tubercle, caseous masses, iron-grey infiltration and fibrinous tissue in unequal quantity, and irregular cavities. The distribution, however, usually differs, one of the chief differences being that in adults the tubercular processes appear to have a special affinity for the apices; in early childhood there is no such predilection, the hilus of the lung or base being frequently affected before the apex. The bronchial glands are almost constantly found involved, with also the small pulmonary glands which accompany the bronchi, the latter suppurating and forming small cavities near the root of the lungs. In this way a tuberculosis may spread into the lungs from the hilus. Not infrequently one or both bases are worn-out from caseating pneumonia with ragged cavities, at other times a similar state of things is found at the apices. In other cases both lungs are stuffed with clusters of grey or yellow tubercles surrounding the terminal bronchi. There may be tubercle on the surface of the pleura, with more or less pleurisy or small local empyemata. The abdominal organs are exceedingly apt to be affected: cheesy masses are frequently found in the liver, spleen and kidneys; cheesy mesenteric glands and ulceration of the intestines are very common in cases of general tuberculosis. Tubercles are not infrequently found on the peritoneum and other serous membranes, as the pleura and meninges of the brain. Tubercular disease of bone may be associated with a general distribution of tubercle throughout the body.

The changes found *post mortem* in young children suffering from chronic or subacute tuberculosis compared with those found in the chronic phthisis of adults may be summed up as follows:

1. Frequency with which the lungs (in children) are invaded with tubercular deposits from the root of the lung in consequence of an infection from caseating bronchial glands.
2. Frequency with which the lymphatic glands of the body become tubercular.
3. Frequency with which massive degeneration takes place in the lungs, *etc.*, grey tubercle being less common.
4. Frequency with which the liver, spleen, kidneys, mesenteric glands, peritoneum, and intestines are the seat of tubercular changes.
5. Frequency of tubercular meningitis and of caseous tubercle in the brain.

Symptoms.—If the diagnosis of phthisis in the early stages is difficult in adults, when it is possible to carefully auscultate and percuss the apices of the lungs, examine the sputa for bacilli, and cross-question the patient concerning the symptoms presented, it is necessarily much more difficult in the infant or young child, where the symptoms are rarely definite and where the lesions are so widely spread throughout the body. The younger the subject the more likely are the symptoms to be wanting in distinctness and the diagnosis to be consequently difficult, frequently wanting and a

family history of tuberculous being nearly all there is to go by. The temperature is usually hectic, normal or perhaps subnormal in the morning and reaching 102° or 103° in the evening, though this may be reversed. There may be diarrhoea without apparent cause, and various dyspeptic troubles; cough, though this may be absent; perhaps enlargement of some external glands. An examination of the lungs may reveal very little, perhaps some want of resonance over the base or apex or in the interscapular region or axilla, with some ringing consonant riles or crepitation. There is progressive wasting, which in a child of over a year or eighteen months is more suspicious than in an infant a few months old, where wasting is more often due to chronic intestinal catarrh than to tuberculosis. In those cases where wasting and hectic follow measles, whooping-cough, bronchitis, or broncho-pneumonia, there is a strong suspicion of tuberculosis, even though there may have been a period of comparative health intervening between the acute attack and the hectic supervening; a family history of phthisis would make the case look still more threatening. In the latter stages the symptoms become more decisive. The hectic continues, the wasting is progressive, the cough is troublesome, the diarrhoea perhaps is still present, parietic stomatitis makes its appearance, the feet, hands, and face become emaciated, and the child is anæmic and very weak. Examination of the chest will now show some marked dullness or loss of resonance over some portion of lung, apex or base, with bronchial breathing and sharp consonant riles; often one is surprised to find how little can be detected in the chest, even when it is evident that the child is far advanced in tubercular disease. The typical signs of a cavity can rarely be elicited, inasmuch as the cavities in the lungs of infants and young children are not often larger than nutshells or walnuts; most frequently they have irregular and ragged walls. A cracked-pot sound may sometimes be elicited in front, but on account of the yielding nature of the chest walls in an infant it is of no diagnostic value as regards a cavity.

Diagnosis.—Whenever wasting occurs as a prominent symptom during infancy and childhood, tuberculosis is certain to be thought of; wasting occurs in all dyspeptic diseases during infancy, and it may simulate the wasting of tuberculosis when it occurs in connection with empyema or broncho-pneumonia in young children. An empyema may readily be mistaken for tuberculosis of the lung if a careful examination of the lungs is not made, aided if necessary by an exploratory puncture, as there is wasting, hectic, and cough. The difficulty in deciding may be great without exploration if the empyema is localized or there is more than one. A chronic effusion in the peritoneum may be mistaken for tubercular disease. It is often difficult in cases of chronic broncho-pneumonia, the chronic condition following an acute attack, to decide if a tubercular process is going on. There may be wasting and hectic, and yet after some weeks the temperature will gradually fall, the lung clear up, and the child perfectly recover. In most cases only the progress of the case will decide the question.

Older Children.—After the age of six years—in other words, after the commencement of the second dentition—chronic tuberculous much more frequently resembles the chronic phthisis of adults than it does before this era. As the child gets older the resemblance becomes still more close.

Children before this age rarely suffer from chronic tuberculosis of the adult type. The early symptoms are those of cough, loss of appetite, diarrhoea, wasting, night sweats, and hectic; progressive weakness; the symptom which we miss for the most part is hæmoptysis, which, though sometimes present, is much more frequently absent in children than in adults, and less blood is expectorated. An examination of the chest may perhaps disclose some loss of resonance at one apex (usually the right), with perhaps some rhonchi or moist rales, or there may be no loss of resonance, only the signs of a chronic or subacute bronchial catarrh localised in the apex of a lung; or there may be impaired resonance only, due to the presence of a thickened pleura and adherent lung. In this stage children perhaps more often than adults improve under treatment and a careful hygiene, and may be restored to perfect health; there is abundant evidence to demonstrate this. If the disease progresses the hectic and wasting continue, the child becomes pallid and weak; the diarrhoea frequent and troublesome, especially following meals; the physical signs show an extended area of lung involved, the tubercular infiltration travelling from the apex towards the base, and giving rise to cavernous degeneration, fibroid changes, and cavitation. The progress of such cases is apt to be more rapid than it is in adults, a fatal result occurring in four to six months. In the last stages the emaciation is extreme, the feet oedematous, bed sores are apt to form, and while the patient may linger for a while if no intercurrent affection brings the end quickly, it must be borne in mind that such cases are exceedingly apt to be brought to a conclusion by tubercular meningitis in any stage early or late. The abdominal organs are also apt to join in a more extensive spreading of tubercle than in the case later in life; mesenteric disease, extensive ulceration of bowels, peritonitis subacute or acute, are apt to be present, and necessarily influence the course of the disease. Hæmoptysis, which may be fatal almost immediately, occasionally occurs; in other cases blood may be expectorated in considerable quantities.

Sometimes an **acute phthisis** takes place without any tuberculous being present; the tubercular process taking the form of clumps of grey tubercle surrounding the bronchi, the process beginning at the apex and travelling towards the base, the symptoms being those of a rapid phthisis, perhaps extending over a month or two.

On the other hand, a **fibroid phthisis** essentially chronic in its course may take place, appearing at times to be stationary, or the patient undergoes considerable improvement. In these cases there is much fibroid change and iron-grey induration of lung with retraction of chest. The physical signs develop slowly, there is fullness of an apex, which gradually becomes almost absolute, intense bronchial breathing, constant rales and gradual retraction of the affected side. The child may fatten and appear to flourish, and present a normal temperature, but it is easily exhausted, suffers from dyspnoea on exertion, its face and lips are turgid, and the fingers become clubbed. In a few cases there is hæmoptysis, but this is the exception. It is possible that the process may become arrested, the lung being converted into fibroid tissue. In the majority of cases the disease is progressive, and the opposite apex becomes affected. The whole course may extend over several years, unless bronchitis or some other intercurrent disease supervenes.

The principal clinical differences between chronic phthisis in older children and adults may be summed up as follows:

1. Frequency with which children in the first stage recover.
2. Frequency with which the disease is brought to an abrupt termination by some acute affection, as tubercular meningitis, pleurisy, peritonitis, or acute milary tuberculosis.
3. Comparative rarity of hæmoptysis in the early stages and of hæmaturia in the latter stages.
4. Frequency of complication with abdominal tuberculosis.
5. Comparative rarity as compared with that of adults of extensive cavities in the lungs.

The *post-mortem appearances* are mostly similar to those found under similar circumstances in adults. Irregular ragged cavities, varying in size from a hard nut to a walnut, most numerous in the upper lobes, with cheesy masses and blood-redulations; the same condition in the lower lobes in an earlier stage, with more or less congested lung. As a rule there is not much grey tubercle, but caseous masses, sometimes associated with peribronchial grey or yellow tubercles. There are not often cavities of large size, but these occur at times; in one case, in a boy of eight years, who had suffered for six months, there was a cavity in the upper two-thirds of the left lung as large as an adult's clenched fist. Pleurisy and small collections of pus are not uncommon. The bronchial glands are almost invariably enlarged and caseous.

Instead of the above, especially in the more acute cases, the lungs may be everywhere infiltrated with clusters of peribronchial tubercles, which crowd the upper lobes, where ragged irregular cavitation is commencing, while they are more sparsely scattered through the lower lobes.

In tubercular phthisis an extensive portion of one or both lungs is caseated and solid, bands of fibrous tissue run across, there is much grey infiltration, dilated bronchi, caseous glands, and perhaps small ragged cavities. Other portions of lung are hypertrophic or emphysematous, perhaps containing scattered clusters of peribronchial tubercles.

Cheesy tubercles are met with constantly in other organs than the lung, especially in the liver, spleen, and kidneys; caseous mesenteric glands and ulceration of the intestines may also be associated with lung mischief.

Treatment.—The treatment of enlarged and caseous glands is necessarily the same in large measure as that of early tuberculosis. If a child, say one from three to six years of age, suffers from a hacking paroxysmal cough, is slightly feverish at night, remains in a condition of ill-defined malaise, especially if he has recently suffered from bronchitis, whooping cough, or measles, the suspicion will be raised that there is either enlargement of the bronchial glands or an early tuberculosis of the lungs. There can be no certainty about the diagnosis, but if the family history points to tuberculosis there is only too much reason for anxiety. The indications for treatment which suggest themselves are to place the child under conditions in which there will be the least possible irritation of the lungs and bronchial tubes, and to supply him with nourishment in suitable quantities and in the most digestible forms. It is needless to say that these indications are fulfilled with difficulty or only partially. Residence in the smoke and dirt of large towns, or on damp

day-sunbaths, is alike bad, and if possible the child should be removed to some breezy moorland site or bending seashore place. Fresh air when it can be taken without risk of cold is of the greatest possible advantage in bracing up the digestive organs. In winter, if it be impossible to seek a warmer climate, thoroughly warm and well-ventilated apartments free from draughts must be secured. A well-warmed but not 'stuffy' house is a great advantage, as the child may in such a case have the 'run' of the whole house without being exposed to cold passages and open windows. A nourishing, easily assimilated diet should be prescribed, a variety being introduced in order to tempt the capricious appetite often present. A cup of beef tea the last thing at night will often ease the cough and soothe the child to sleep.

Of special medicinal treatment, cod liver oil, malt extract, mineral acids with creosote and the hypophosphites may be prescribed with advantage. Creosote or guaiac is often prescribed. Counter-irritants are useful; they are hardly likely to have much effect on glands which are actually calcifying, but they undoubtedly favourably influence chronic catarrhs of the bronchial mucous membranes. Among the milder ones, the lin. pot. iodid. c. uponis may be rubbed into the chest every evening, a piece of 'moulinet' or layer of cotton wool being applied. A stronger application may be made by diluting lin. iodii with glycerine and water (F. 2/3) and applying it to the sternum or the subclavicular region every night and covering it over with a layer of cotton wool. Care must be taken not to render the skin sore by applying it too frequently on the same spot.

The more urgent symptoms present when the nerves are involved by a mediastinal tumour—and these are often very distressing—may be relieved in many cases by warm applications, such as frictions, and small doses of opium or morphia. Relief will probably be obtained from opiates combined with ether or chloroform if the dyspnoea is due to spasm. Inhalations of chloroform, ether, or nitrite of amyl, usually relieve. Small doses of morphia given subcutaneously may be tried.

Much that has been said applies to the early stages of all forms of chronic tuberculosis of the lungs. It is of the greatest possible importance to spring-rise the disease in its early stages, when there is a fair probability that it may be arrested or undergo a *remission*—if the conditions are favourable. To this end an equable temperature, a pure bracing air, protection from cold and damp and rapid temperature changes are of the greatest importance. The presence of tubercle in the lungs naturally predisposes to catarrhs and local pneumoniae, and exposure to unfavourable conditions likely to favour their development is certain greatly to aggravate the disease. Great care must also be taken in the food which the child takes and in treating any departure from a healthy condition of the child's digestive system. A condition of catarrh of the bowels is very often present in tubercular diseases apart from any local lesion, and is an important factor in producing the wasting which accompanies tuberculosis.

CHAPTER XIII

THE SPECIFIC FEVERS

Feverishness.—Children more often than adults are apt to suffer from attacks of feverishness, the temperature perhaps rising suddenly without any obvious cause, remaining raised for a day or two, much to the alarm of the friends and the medical attendant, and returning to normal without any clue having been obtained as to the cause. Perhaps the feverishness is less acute, but continues for some weeks, rising in the evening and falling in the morning, without any diagnosis being made. It is hardly needful to insist that in any given case no effort should be spared to find out the cause of the fever, and to effect this the child should be carefully examined, its chest being stripped and any sign of pneumonia carefully looked for, while the skin and throat should be minutely scrutinised in a good light. Inquiries should be made as to what the child has taken in the way of food prior to the attack. If the attack is sudden, the temperature rising to 102° or 104° or more, epidemic influenza, acute pneumonia, scarlet fever, or acute dyspepsia from the ingestion of indigestible food will doubtless be suggested.

In children under three years of age, a high temperature with convulsions may be due to acute pneumonia, and a careful examination of the lungs should be made; in older children there may be no convulsions, but usually, if the physical signs are not distinctive, there is some stich in the side felt on coughing, with more or less dyspnoea. In scarlet fever there is usually vomiting and often diarrhoea, and the appearances in the throat and skin soon become distinctive. During the first twelve or twenty-four hours it may be difficult to distinguish between scarlet fever and an acute diarrhoea or gastro-intestinal catarrh the result of improper food, as sometimes a gastric attack will produce severe symptoms of vomiting, diarrhoea, and fever. Or there may be no diarrhoea or sickness and only feverishness. The diagnosis in epidemic influenza has often to be made from the fact that it is prevalent in the house or neighbourhood rather than from the symptoms, which are so frequently indefinite; a temperature of 104° or 105° with convulsions is not uncommon. In many of these cases it is wise to wait before giving a definite opinion. In infants and young children the cause of an unexplained high fever may prove to be an acute otitis which has been overlooked till pus has made its appearance at the external meatus; such cases are very apt at first to be mistaken for meningitis (see fig. 36).

In some feverish attacks we have noticed an enlargement of the cervical glands, either the deep cervical at the angle of the jaw, or the glands under the upper part and posterior edge of the sterno-mastoid, without any appearances

of irritation in the tonsil or pharynx; possibly there may be such a disease as an acute idiopathic adenitis, or some poison may perhaps be absorbed from the pharynx and enter the glands without setting up any local lesion at the point of absorption.

Such cases have been described by E. Pfeiffer, Heahner, and Rauchfuss, under the name of **gland fever**. The attack, according to Pfeiffer, is sudden and the fever moderately high; there is complaint of tenderness in the neck, and some of the cervical glands, usually those at the posterior border of the sternomastoid, or the occipital glands, are swollen and tender. In a few days the temperature falls and the glands become normal. In a few instances the attack has been more severe and has lasted longer. In these cases no



Fig. 3A.—Thermotile Chart showing high temperature due to an acute otitis in a child of seven months.

abnormal appearances have been detected in the tonsils or nasal mucous membrane. The glands never suppurate. Pfeiffer has noted several of these cases in one house at the same time, the disease being infectious or epidemic.

We are, however, rather inclined to think that while 'gland fever' does undoubtedly take place, it is rarely idiopathic, but the result of absorption of toxic materials from a mucous membrane. 'Gland fever' often occurs in scarlet fever and other various forms of tonsillitis, the throat may be apparently well or hardly abnormal, yet the cervical glands may be swollen and tender and the patient feverish.

Acute central congestion or 'mumps' may be accompanied by high

fever, quickly followed by death. In many cases when there are a high temperature and cerebral symptoms, such as coma, delirium, or torpor, it is often difficult to say whether there is some cerebral disease, or whether the high temperature and poisoned blood are not causing the cerebral symptoms, the brain itself being normal. When the temperature rises more slowly, taking several days to reach its greatest elevation, as is the case in measles, typhus, typhoid, and smallpox, a diagnosis cannot be made for a few days, till characteristic symptoms develop. The hoarse cough, suffused eyes, and rash of measles, the headache, delirium, and coma of typhus, the headache, and rashes of smallpox, settle the diagnosis. This is sometimes the case in erythema nodosum; there are some few days of fever with no definite

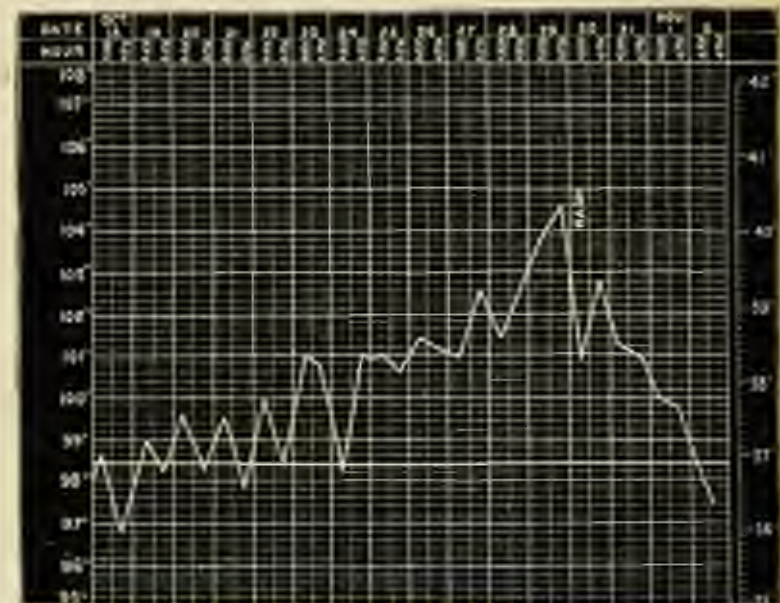


Fig. 37.—Temperature Chart of a case of Erythema Nodosum. The left axis is hospital thermometer (see *Scale Thermometers*). The course of this fever was uncommon, but a number of typical cases might thus appear.

symptoms, and then the characteristic red flattened nodes make their appearance; see fig. 37.

The diagnosis as to the cause of fever is often very difficult when the fever assumes the intermittent or remittent type, going on for some days or weeks without any characteristic symptoms developing. Such cases were formerly designated 'low' or 'continued fever,' and while it is not wise to use such indefinite terms, we must be prepared to find cases of intermittent fever in children in which it may be quite impossible to make a diagnosis. A salivary or chronic gastro-intestinal catarrh, creeping pneumonia, a low form of malaric fever, a tubercular peritonitis or a miliary tuberculosis, may

be present. There may be, as Dr. Foxwell suggests in these cases, a condition of general catarrh, including both alimentary and respiratory tracts. In all such cases a most careful examination should be made of the chest, abdomen, and rectum for urinary tubercles, in the hope of detecting something which will throw light on the attack. We must not forget that some of those cases of protracted remittent fever are in reality cases of urinary or local tuberculosis in which healing eventually takes place. We feel sure we have seen such cases.

Scarlet Fever

Scarlet fever is a specific fever of a highly infectious and dangerous character which occurs in epidemics, but is always more or less endemic in large populations. It is easy to understand the occurrence of epidemics in a small population where the fever exhausts the soil, as it were, by attacking all those susceptible to its influence and then disappears for a while, to prevail at a later period, when the infection is reintroduced and the population contains again a number of the unprotected. It is more difficult, however, to understand the cause of epidemics in large cities where the infection is always present, unless we assume the existence of some unknown influence which favours the spread of the disease at one time more than another by rendering those who are unprotected by a former attack more than usually susceptible to the infection. Thus epidemics of scarlet fever are more common and widespread in the autumn than at any other period, and it would appear that at this season either the poison is apt to be more intense or individual susceptibility greater. Individual susceptibility varies greatly with age: infants under six months of age are rarely attacked, during the second year the susceptibility is greater, while children during their fourth and seventh years are most often attacked. The susceptibility then appears to diminish as age increases, though, as already remarked, varying strangely from time to time. Thus it may happen that a medical man or nurse may come in contact with scarlet fever cases for weeks or perhaps months without contracting the disease and yet finally take it. In one case which came under our notice a probationer nurse was engaged in turning in a scarlet fever ward for six months without being attacked; many months after, while turning in a surgical ward at another hospital, she contracted a smart attack of scarlet fever from a sporadic case arising in the ward. In another case a child had a severe attack of scarlet fever twenty-nine days after admission to the scarlet fever ward. In this case it was supposed to have had an attack of scarlet fever for which it was sent in, but second attacks of scarlet fever are rare; they do, however, undoubtedly occur, as in the following case:

Scarlet Fever, second attack.—Thomas B., aged 5 years. Vomited June 26, (with some dry); admitted in hospital June 26. There was a well-marked rash, the limbs were swollen, with patches of exfoliation; there were two or three degrees of fever for a few days. Discharged August 20. He vomited August 25; admitted August 25 with a typical attack of scarlet fever. There was a well-marked rash, sore-throat, and fever.

Scarlet fever is apparently not so infectious as measles—a large number of children and adults escape being attacked; thus Biedert found in an epidemic

which prevailed in an isolated village (Norraholmen) where the inhabitants freely mixed with one another, and where no isolation of the fever patients was possible, that about 58 per cent. of the children unprotected by a former attack contracted the disease, though only about two-thirds of these had well-marked symptoms, the rest having some thymus only. In different epidemics the number attacked varies extremely.

The *mortality* varies in different epidemics; thus, in the fever ward of the Children's Hospital, Manchester, it has varied from 6 to 25 per cent. in different years during the years 1877-87, the average mortality among 1,366 cases treated being 11.8 per cent. During the seven years 1888-1894 (inclusive) 4,015 cases were treated with an average mortality of 8.6 per cent. This average mortality closely corresponds with the figures given by Collie of the mortality in the London, Stockwell, and Hamerton River hospitals, where, in sporadic outbreaks of scarlet fever, the mortality was 12.5 per cent. As in all probability many of the milder cases of fever never come into hospital at all, 10 per cent. mortality given by W. Squire as the average appears to be as nearly correct as possible. Age influences the mortality very considerably; the mortality is high during the first three or four years of life, amounting to 25 to 30 per cent.; it continues high till the age of six or seven years is reached, declining after this till the age of twenty-one, again increasing after this epoch.

Are there any morbid conditions of body which predispose to scarlet fever? Very little is definitely known about such conditions; individual susceptibility varies in the most erratic manner, at least is governed by unknown laws, and it cannot be said that ill health in any way either favours or protects from attacks. To this, however, must be added that it is our experience that operation cases and surgical cases with open wounds are more liable to contract the disease than are healthy children. The so-called **surgical scarlet fever** is simply scarlet fever occurring in a surgical case (vide infra).

The *severe* and healthy appear to be as frequently attacked as the weakly, and the attacks are often fatal to such; it is by no means uncommon to see in the *post-severe* table children who have succumbed to malignant scarlet fever looking fat and plump, and who were apparently in the best of health when attacked.

The *transference of infection* from the sick to the healthy takes place in various ways; it may be by direct contact, the breath or the exhalations from the fever patient may be inhaled, or it may be carried by means of clothes or wearing apparel or bedding which has been in contact with the sick. It is highly probable also that the excretions of the patient are infective, the urine, feces, and discharges from the ear or nose. From the investigations of Power and Klein it seems that the fever may pass from cattle to man by means of the milk of cows suffering from a form of *bovine fever* known by the name of 'nose tears.' The poison of scarlet fever appears to retain its vitality for many months, fever breaking out again and again in houses which have been imperfectly disinfected.

Incubation.—Mostly two to five days, though it may be much less, perhaps only a few hours; forty-eight to seventy-two hours is a common period, but in many cases where slight sore throat precedes for some hours the more definite symptoms it is impossible to state the period of incubation with

exactness. In the majority of cases, if the initial vomiting be taken as the first symptom, it will be found that the incubation is under three days. It cannot be said with certainty that it may not be more than five days, but such cases must be very exceptional.

Prodromatory Symptoms.—The invasion in the case of children is usually sudden, the first symptom being nearly always vomiting; this may come on after a heavy meal. There may also be diarrhoea. In older children and in adults there is usually nausea first, vomiting, sore throat, headache, shivering, and loss of appetite. 'Sore throat' with vomiting in a child or adult is extremely suspicious of scarlet fever, especially if fever is present. The temperature usually runs up quickly to 103° or 104° , and perhaps the patient sits over the fire on account of feeling chilly; in some cases there is slight delirium.

An attack of vomiting and diarrhoea coming on suddenly with feverishness (103° – 104° F.) is very probably the commencement of scarlet fever, and in such cases death may take place within twenty-four hours of the onset.

Symptoms and Course.—**Median Form.**—The prodromatory symptoms are usually followed within twenty-four hours by the characteristic rash. This is said to make its appearance first about the neck, but there is no certainty about this, and traces may be seen of it on the backs of the hands and wrists, or on the thighs or abdomen, when it is present somewhere else. In some cases it is first visible on the back. At first the rash is faint though perfectly characteristic, taking two or three days to reach its height. In other cases it disappears in the course of twenty-four or forty-eight hours, leaving at no time been more than a fine faint rash. When typical it cannot be mistaken for any other rash. Viewed from a short distance, the whole body excepting the face is of a uniform bright red colour; examined closely, it consists of a multitude of red points which correspond with the hair follicles; these points are surrounded by zones of erythematous redness which, joining with one another, give a general diffuse red appearance to the skin. Sometimes the rash consists of the points only without the erythema; in this case the redness is necessarily less vivid. In rough skins the rash may be coarsely papiform; that is, there is a condition of 'goose skin,' each point being large and the rash therefore coarse. Sudamina are not uncommon. In other cases the rash is patchy on the limbs, and when this is so, the case may simulate measles; the patches consist of clusters of fine papules or points with much surrounding erythema, while normal skin is present between the patches. Sometimes the rash is hæmorrhagic, minute extravasations of blood taking place into the skin; this may occur in mild cases. It is, however, much more common in malignant cases. Purpuric patches are not uncommonly found after death that were not present during life. Towards the end of the first week the rash, which has been fading for several days, is succeeded by desquamation, which is fine or slight according to the intensity of the rash. This exfoliation of the epidermis generally goes on for many weeks, being posset longer about the hands and feet. The nails are red, swollen, and covered with an excess of mucoid secretion, yellow points corresponding to the follicular crypts are usually present, sometimes there are patches of yellow exudation; the soft palate, uvula, and pharynx are more or less congested. The nasal mucous membrane is frequently involved, so

that there is much discharge from the nose. The deep cervical glands at the angles of the jaw are usually enlarged. The tongue is coated with a thick white fur; not infrequently there is a dry glazed central band on the dorsum; in the course of a few days the tongue clears, leaving a red clean glazed tongue with prominent fungiform papillae—i.e. 'the strawberry tongue.' The eyes are often inflamed and the conjunctivae injected, and with this there is often sleeplessness or delirium, no doubt due to a congested state of the membranes of the brain. In rare cases the delirium is severe and the patient violent.

The pulse is quick, varying from 120 to 130, often faster than the temperature.

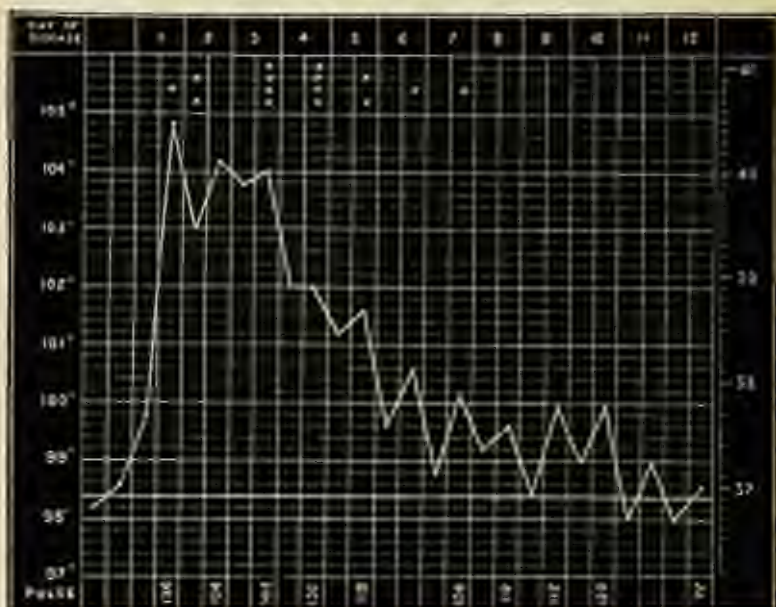


FIG. 34.—Temperature Chart of a case of Scarlet Fever, medium attack. M. K., aged 13 years.
A. Rash present.

on the general state of the child would have led one to expect; the temperature varies, mostly reaching 103° or 105° in a moderately sharp attack (fig. 38). The urine is scanty, high-colored, and often contains a small quantity of albumen. In the course of a few days, perhaps by the end of the third or fourth, the attack has reached its height, and the symptoms begin to decline. The rash gradually fades, the temperature falls, the evening rises being smaller and the morning remissions more marked; the tongue clears, the fauces are less injected, and the appetite returns. By the end of the first week the temperature has reached normal; any feverishness which continues after this suggests some complication, the commonest being an ulcerating or sloughy process going on in the throat, inflammation of glands, and otitis. If

must, however, be added that attacks of scarlet fever are extremely irregular and no two cases are exactly alike.

Mild Scarlet Fever.—In some cases the premonitory symptoms are absent or the fever is only slight and easily overlooked, and the first thing to call attention to the attack is the rash. It not infrequently happens, even in hospitals where the children are under observation, that the discovery of a rash is the first thing noted. The child may seem to be in its usual health, make no complaint of sore throat, and appear to take its meals well, with an evening rise and a morning remission of temperature, and yet be suffering from a mild attack of scarlet fever (fig. 39). The rash in such cases is rarely well marked, but if it is diffuse and punctiform and remains visible for twenty-four or forty-eight hours, the attack is unmistakably one of scarlet fever. There is usually slight tonsillitis. The most difficult cases to dia-



FIG. 39.—Temperature Chart of a Mild Scarlet Fever. (L. W. Spill, Johns Hopkins Hospital.)

gnose are those where there is sore throat without rash, inasmuch as there is nothing characteristic about a streptococcal sore throat.

Malignant Scarlet Fever.—In some cases death occurs very rapidly, perhaps within twenty-four hours, though this is rare. The most rapid case which has come under our notice was that of a girl of twenty months.

Scarlet Fever rapidly fatal.—She was noticed not to like her dinner well, and vomited after her tea; her temperature, which had been normal in the morning, had risen to 101° by 5.30 (fig. 40); at 5 P.M. the pulse was 120, the tonsils were enlarged, and there was a very faint rash over the body; she was removed the same evening by the resident medical officer, Dr. Kershaw, to the fever ward. Next morning the rash had disappeared, the tonsils were enlarged with a patch of exudation on one of them, her pulse and respiration were rapid, but she did not seem extremely ill. She gradually became worse, the face swelled, respiration gasping, and pulse fading; she died some time 5 P.M., twenty-four hours after the initial symptoms of vomiting.

At the post-mortem one bronchus was laughing and soft. Death in this case, as in most rapidly fatal cases, took place through the heart failing

under the influence of the poison, they may not appear for a few hours or until danger, then symptoms of cyanosis and collapse set in, quickly followed by a fatal result. In the great majority of acute cases death does not take place till the fourth or the seventh day (fig. 40 F); in these the temperature is high, perhaps 105° or 106° , there is much diarrhoea, often extreme restlessness, followed by coma; the vessels are much swollen and covered with fat secretion, there is much nasal discharge, the glandular swelling and redness are great, the neck being hard and tender to the touch; the skin is of a dull lurid colour, the extremities cold, and the heart gradually fails. If life is



Fig. 40A. - Temperature Chart of Malignant Scarlet Fever. Death on sixth day.

Fig. 40B. - Temperature Chart of Malignant Scarlet Fever. Death on 7th day.

prolonged for a few days the vessels and soft palate atrophy and the lungs become the seat of septic pneumonia. In another class of cases in which life is prolonged to the end of the second or third week, a condition of **septicæmia** is set up. The pupils otherwise, slightly patches appear on the faces, the glands become enlarged and swelling, the nasal mucous membrane discharges a purulent secretion, and the conjunctivæ become affected; the temperature is remittent but continues high, the urine albuminous, pus wells out from both ears, the child gradually wastes, and dies in the course of ten or fourteen days. At the *post-mortem* there are found extensive sloughing along the fauces, pleuro-pneumonia, and large hæmorrhages

rhagic kidneys with minute abscesses. In some cases the temperature remains high during the second or even third week without any local lesion being discoverable to account for it. In all such cases the lungs should be carefully examined, and the possibility of some septic inflammation going on in the kidneys should be borne in mind.

Prognosis.—A guarded prognosis must always be given in the case of young children, the throat complications in these being generally serious. The tonsils are apt to slough, and they have so little power to get rid of the food secretion which rapidly forms in the pharynx and nose that they are extremely liable to pneumonia from extension from the pharynx and glottal inflammation. Diarrhoea is always a serious symptom; when present at the onset it points to a sharp attack, in the later stages it is also of evil omen, and if a marked symptom it usually portends a fatal result. Drowsiness at the onset and during the course of the attack is an unfavourable symptom, as it usually accompanies a high degree of fever and a severe course. In all cases where the temperature is maintained during the second or third week the prognosis must be exceedingly guarded, and the possibility of a fatal septicæmia supervening must be borne in mind.

Coughing and Soreness.—Many of these have already been referred to:

(1) The **tonsils** may become deeply excavated, the soft palate may slough, a small hole appearing through the velum, to be followed perhaps by an almost entire destruction of the soft parts; in the rare cases when recovery follows, cicatrization and deformity of the soft palate are the result. The inflammation may spread to the epiglottis and larynx, and asphyxia symptoms become so urgent that tracheotomy is required. The trachea and larynx may become the seat of false membrane. In rare cases the ulcerating process in the throat may reach and enter the internal carotid or jugular vein and death follow from hæmorrhage.

(2) The **nasal and conjunctival mucous membrane** may be the seat of inflammation or a fibrinous exudation. A chronic discharge from the nose and a consequent scrofulous condition of the upper lip may be left after the fever.

(3) **Oums.**—The inflammation may spread along the Eustachian tube to the middle ear, and pus be formed in the tympanic cavity, which finds its exit by perforation of the membrane. This may happen during the fever or during convalescence. We have known it occur as early as the fourth day, in other cases when convalescence is well established. Suppuration in the tympanum is one of the common causes of a continued elevated temperature after the disappearance of the rash; the child may suffer very little pain, and the presence of pus in the external meatus or staining the linen may be the first thing to call attention to this complication. At other times the child will put its hand to its ear and frequently shake his head, as if to get rid of some source of irritation. Pyæmia and abscesses in the lungs may follow if thrombosis of the lateral sinus occurs.

(4) The **cervical glands** frequently become enlarged and suppurate, either during the course of the fever or when the child is convalescent. In some cases, more especially in weakly children, much sloughing may go on about the neck, deep ragged ulcers being formed, exposing the large vessels; fatal hæmorrhage may occur from the latter.

(5) **Broncho- or pleuro-pneumonia** occurs very frequently during the second week, and is due to extension downwards of the lesion from the throat. Pneumonia followed by empyema may take place during convalescence.

(6) **Synovitis and Rheumatism.**—The joints are apt to become swollen and tender at the end of the first or beginning of the second week; those most impressibly affected are the wrists and small joints of the hand, whilst sometimes the synovial sheaths of the tendons at the back and in the palms of the hands are attacked. The knees, ankles, soles of the feet, elbows, and joints of the cervical vertebrae may be affected. Movement of the affected joints causes pain, and they are mostly swollen, red, and tender. The affection is usually severe, being fugitive, and seldom returning to the same joint. The knees sometimes remain swollen for some weeks from effusion into the joints. The cases complicated with synovitis are usually severe, though exceptions occur. Post-endocarditis occurs much less frequently than in the ordinary form of rheumatism. Syneresis sometimes occurs in association with nephritis during the second week. Attacks of acute rheumatism are apt to occur during convalescence, but such are more common in young adults than in children; these attacks differ in no particular from ordinary rheumatism, the heart being frequently involved. An attack of scarlet fever during convalescence from rheumatism not infrequently causes a relapse.

(7) **Pyæmia and suppuration in the joints** occasionally occurs; any joint may be affected. Such cases are nearly fatal, though not invariably so.

(8) **Pericarditis or endocarditis** may occur without joint pain or nephritis being present.

(9) **Nephritis.**—No complication of scarlet fever can be of importance or interest with nephritis, and this condition often gives rise to much anxiety in an otherwise mild and favourable case. The 'initial' albuminuria which frequently accompanies the febrile state in the first week of the disease is not of much importance, as it is usually temporary and not due to any important lesion of the kidneys, and quickly disappears as the fever subsides towards the end of the first week. Apart from this febrile albuminuria, there are two forms of nephritis which, it is important to bear in mind, are distinct from one another, though they have frequently been confounded and much confusion has arisen in consequence. They may be distinguished as (a) Septic nephritis, (b) Post-scarlatinal nephritis.

(a) **Septic Nephritis.**—In the severe forms of fever complicated with sloughing throats and soft palate and much glandular swelling the urine is albuminous, frequently highly so; but it rarely contains blood in appreciable quantities or casts; there are indeed no renal symptoms, or if there are they are so masked by the general condition of septicæmia that it is difficult or impossible to differentiate them. There is no dropsy or uræmic phenomena. If the patient survives till the end of the second or third week, a more or less typical pyæmic kidney is found at the *post-mortem*. The kidneys are enlarged, frequently very much so; they are flabby, of a cream colour on the surface, with minute hæmorrhages and usually minute abscesses. On section the cortex is of the same cream colour mottled with injected vessels and points of fluid or impurified pus. This condition of

kidney forms part of a general condition of pyæmia, and is chiefly of interest in demonstrating that the kidneys suffer during the course of the disease itself, and consequently in cases which recover are in a condition which predisposes to inflammatory affections during convalescence.

(5) **Post-scarlatinal Nephritis.**—This is the form which is liable to supervene during the third or fourth weeks, and which is known generally by the name of scarlatinal nephritis. There can be little doubt that the kidneys are actively engaged during the course of the fever itself, and for the succeeding week or two, in carrying off the waste products formed during the fever, and are in an irritable condition and prone to take on inflammatory action, in the same way as the bronchial tubes and lungs are left in an irritable condition after measles and are apt to suffer from inflammatory attacks; and while it is possible in both cases that nephritis and pneumonia may supervene in spite of the greatest care, yet any chill or exposure to cold is extremely likely to produce or determine such an attack. The number of those who suffer varies in different epidemics, and also according to the season and the care which is taken of them during convalescence. Taking an average of several years, we find about 6 per cent. of our hospital patients have suffered from post-scarlatinal nephritis. Patients who have had the primary fever both in a severe and mild form may be attacked; in the former class of cases, especially where there has been no period of apyæmia, it is mostly fatal; in the latter class—at least in hospital—it is rarely so fatal. The prognosis is usually bad in those cases where the temperature continues elevated during the second week, in consequence of severe pharyngeal or glandular inflammation, and which contract nephritis in the third week, the latter complication supervening on the throat lesion. From the fourteenth to the twenty-sixth day is the commonest time for nephritis to supervene, but as it usually begins insidiously, traces of albumen being present for a few days before blood and larger quantities of albumen appear, it is often impossible to determine the exact date of the commencement of the attack. In well-marked cases it is noticed by the attendants that the child which, since the subsidence of the fever, has been practically well, becomes restless, fæcal at night, thirsty, has a quick perhaps hard pulse, and passes small quantities of dark-coloured urine. If particular attention has been paid to the urine, it will probably have been found that it has been diminishing in quantity, and has contained small quantities of albumen for a few days prior to the dark urine being passed. Sometimes puffiness about the face precedes the appearance of albumen in the urine. The urine may be dark red, but usually it is 'smoky,' and on allowing it to stand in a tall glass deposits a dark flocculent precipitate, not unlike the flocculi in beef tea. This precipitate consists of blood corpuscles, epithelium and fibrous cylinders which have been formed in the tubules and consequently may contain corpuscles and epithelium. The supernatant liquid contains a variable amount of albumen, sometimes becoming almost solid on being boiled—more often a half to a sixth of its volume of coagulated albumen precipitates by boiling. It may not contain any blood. For a few days the urine continues dark and albuminous and of high specific gravity (1020-1025), and diminished in quantity, perhaps only a few ounces per diem; the face becomes pale and puffy, there may be œdema of the feet and scrotum, and

more or less constant; then, perhaps, in the end of a week an improvement takes place, large quantities of urine are passed with diminished quantities of blood and albumen, and the child becomes again convalescent, though the urine may contain some albumen for weeks or even months, and the anemia may continue for a long period. On the other hand, in a minority of cases the nephritis is prolonged and symptoms of *uræmia* may supervene, the pulse becomes slow, the temperature subnormal, the tongue dry and brown. Often there is frequent vomiting, sometimes diarrhea (see fig. 41); hemorrhages may take place from various surfaces, especially the nose; there may be anasarca, muscular twitchings, and perhaps general convulsions.

In all cases of nephritis particular care should be taken to examine the heart, inasmuch as a fatal result is very often brought about in consequence of cardiac failure than directly through uræmic complications. One of the



FIG. 41. Prolonged Course of Purulent Nephritis. — (—) temperature; (○) pulse; (□) anæmia.

effects of nephritis is to raise the tension in the blood-vessels, and this, if continued for any considerable time, is followed by **dilatation of the heart**, the tension in the arterial system in connection with moderate strain being responsible for this result. Another not uncommon result is **endocarditis** or **pericarditis**, and possibly **embolism**. The possibility of **death occurring suddenly** during the course of an acute or subacute nephritis must always be borne in mind; the patient may appear to be doing fairly well, perhaps sitting up in bed and playing with his toys, when an attack of dyspnea comes on, the face becomes livid or pallid, the pulse disappears, and death quickly takes place. Sometimes attacks of dyspnea may precede by a day or two the fatal event. Such cases have been often described as being fatal in consequence of œdema of the lungs, the dilatation of the heart having been overlooked; œdema of the lungs is present, but it is secondary to the cardiac failure. The pathology of such cases is tolerably clear; acute nephritis, running a very rapid course in consequence of the kidneys being

almost completely choked, usually terminates with uræmic phenomena; if it runs a slower course, the tension in the blood-vessels throws additional work upon the heart, the left ventricle struggles with the increased work thrown upon it, the blood becomes impoverished and nutrition impaired, the cavities of the heart dilate, and finally that organ gives way, often suddenly at the last. The amount of dilatation present should be carefully noted by the position of the apex beat, and the increase of impaired respiration.

Pneumonia, pleurisy, and peritonitis may occur in the course of septicæmia, and pleuro-pneumonia, ending in gangrene, may take place. In a few cases the attack is exceedingly acute, the temperature being high, 104° to 105° , the tongue dry and brown, the urine containing much blood and albumen, and death rapidly taking place. In such cases there is usually coincident pneumonia. In a large number of cases the attacks are mild, a small quantity of albumen, perhaps without any blood, making its appearance during the third week, the face becoming puffy and the child anæmic, the albumen disappearing in the course of a week or two, and the child after a prolonged convalescence slowly regaining its health.

Total suppression of urine is not common, a few ounces daily being usually passed; in one of our cases only three ounces of pale albuminous urine was passed in the four and a half days which preceded death; there were no convulsions. Life is rarely prolonged beyond the fifth day if there is total suppression. Death takes place in many cases without convulsions; in others convulsions may supervene and recovery follow; the convulsions are not dependent only upon retained urinary products, but also upon the stability of the nervous centres, which differs markedly in different children.

Diagnosis.—The diagnosis of mild cases of scarlet fever often presents extraordinary difficulty, and yet the importance of making a diagnosis is often great. In hospital or dispensary practice cases have mostly to be treated as infectious or non-infectious; as there is often no opportunity of taking a middle course, they must be sent into a fever ward with the risk of contracting the disease if the diagnosis is at fault, or of infecting others if treated with non-infectious cases. In private practice among the wealthier classes it may be possible to isolate all suspicious cases, but such are always a source of anxiety. It cannot be too forcibly impressed that diagnosis in some instances is impossible, and that errors will occasionally be made by the most experienced, though at the same time it must be acknowledged that mistakes are more frequently made through carelessness than from any want of knowledge. The most characteristic phenomenon is of course the rash, and if this is well marked, being diffuse and punctiform, and lasting at least twenty-four or forty-eight hours, even in the absence of vomiting or a high temperature, there can hardly be a doubt about the diagnosis. A measles rash can hardly be mistaken for it, except in those cases where the rash is patchy about the limbs, but in these it is usually diffuse and characteristic on the trunk. A scarlet fever rash, however faint, usually lasts for twenty-four hours at least, in this respect differing from erythematous rashes, which may be present in the evening and gone before morning. It is always well when called to see a rash by artificial light to wait for daylight or give a definite opinion. It is important to bear in mind that a rash more or less resembling scarlet fever

occurs in some cases of pyæmia and septicæmia, also in diphtheria (which, when it occurs, is septicæ influenza, and rubella. A red rash is sometimes caused by belladonna, arsenic, and quinine. To distinguish between scarlatinal and simple tonsillitis is usually impossible in the absence of a rash; the 'strawberry' tongue is generally absent in cases unattended with a rash. Cases of tonsillitis where the nasal mucous membrane becomes involved, or where there is excessive exudation on the fauces or sloughing of the soft palate, if diphtheria can be excluded, are probably scarlatinal. If the lymphatic glands at the angle of the jaw become enlarged and tender, scarlet fever is probable. Acute nephritis occurring after an anomalous rash or sore throat makes it practically certain that the primary attack was scarlet fever.

Medical Anatomy.—In the bodies of those dying during the first few days of the disease, no gross lesions except those in connection with the throat can be detected. One or both tonsils are ragged, perhaps sloughy, the glands are enlarged, perhaps beginning to suppurate, the internal organs are gorged with blood, there are minute hæmorrhages on their surfaces. The heart, liver, and kidneys are pale, the Peyer's glands are swollen, and the mucous membrane of the intestines injected. If the child has survived a week or more, usually septic changes are present; the lungs are in a condition of pneumonia more or less advanced, which is secondary to the sloughy throat and the glandular inflammation and cellulitis in the neck; marked changes are also found in the kidneys if the child has survived two or three weeks. In typical cases these are much enlarged, flabby, pale on the surface, with minute hæmorrhages and injected capillaries; on section minute abscesses may often be seen at the base of the pyramids. On microscopical examination large masses of kidney substance will be found infiltrated with leucocytes, and micrococci (*Streptococcus pyogenes*) will be detected in the capillaries. If death has been the result of post-scarlatinal nephritis, in the early stages the kidneys will be gorged with blood and deeply stained; in consequence of the tubules being choked with casts and the capillaries distended to their utmost. In a later stage the kidneys are enlarged and pale, dripping urine on section, and on close examination it will be noted that the Malpighian bodies are enlarged and pale, standing out prominently like grains of sand dusted on to the cortex. On microscopical examination it will be found that the glomeruli are enlarged in consequence of containing an increase in the number of their nuclei, in some cases fibrous thrombi, and in a later stage being surrounded by a fibro-cellular growth which completely strangulates them and produces complete obstruction. When nephritis is present the cavities of the heart are found dilated; sometimes there is per-endocarditis, pericarditis, or peritonitis.

No specific micro-organism has been discovered in cases of scarlet fever, yet we cannot doubt that such exists. One of the reasons for its non-discovery is in all probability that it will not grow on any of the ordinary cultivation media. There is no difficulty in cultivating various *pus cocci* from a drop of blood taken from the finger of a scarlet fever patient, but this is also true of measles and other febrile diseases.

Treatment.—As soon as scarlet fever is suspected, means must be adopted to prevent the spread of the disease in the household by isolating the patient.

as far as it is possible to do so. It is obviously impossible to effect this in the smaller class of houses, and indeed even in large and well-appointed houses nothing like perfect isolation can be carried out, the removal of the patient to a fever hospital being in all cases the wisest course when it can be managed. To diminish risks of infection as far as it is possible, a room on the upper story should be secured, or, still better, the whole of the top landing should be devoted to the patient and those of the household who are in attendance on him. Every article in the room which can be spared, especially curtains, carpets, and other woollen goods, should be removed, only retaining such as are required for immediate use. The bedding should consist of a horsehair mattress and warm but light coverings. The sick-room should be large and airy, the more cubic space the better, provided it can be kept at a moderate temperature, and all draughts avoided. The attendants on the sick should not mix with the other members of the household, but devote themselves entirely to the work of the sick-room. If there are children in the house who have not had scarlet fever, the question will arise what is best to be done with them. In the first place, it is clear that they must not attend school or mix with other children; the question of sending them away must depend upon various circumstances. Remaining at home unquestionably involves a risk, and at any time so long as the house remains infected they may be attacked. Sending them away involves the risk of their being incubating at the time, and of conveying the infection to another household. The best course, if it can be taken, is to send them away to some household where there are no children, and whence they can be brought back if they are attacked after removal. To send them away to distant seaside lodgings could not be sanctioned under any circumstances; it is better to run the risk of infection at home, than have them sicken away from home among strangers, and become the source of an outbreak elsewhere.

As soon as the diagnosis of scarlet fever is made the child should be put to bed, and remain there as long as there is fever, or, still better, for three weeks, though this, in mild cases especially, is difficult to enforce in private practice. In hospital practice three weeks in bed is the ordinary rule; the object of this being to obviate the risk of catching cold, and it is better to be over-cautious in this respect. The diet for the first few weeks should consist largely of fluids; it is most important that the digestive organs should not be overstayed and that the excretory apparatus, especially the kidneys, should be active, inasmuch as the waste products are increased during fever, and the poison also passes out of the body in this way. During the febrile period, milk and barley water or milk and soda water is the best food that can be given; ferrous children rarely care for beef tea, and all jellies and meat extracts are unnecessary. One or two pints of milk suitably diluted during the twenty-four hours will be quite sufficient; if more is attempted, sickness may not unlikely be produced. Daily sponging with tepid or cold water, to which some *Cosby's Fluid* or other desiccant is added, is of much service. Caution should be exercised in giving baths, and unless the bath can be brought to the bedside, they had better be avoided until convalescence is well established. Whilst desquamation is proceeding, after the spongings or warm baths the skin should be gently anointed with glycerine and starch, weak carbolic oil, or emulsion of cod-liver oil with carbolic acid or eucalyptus.

We have no belief whatever in the possibility of rendering the patient entirely free from infection by anointing the skin. We believe the infection of the fever may leave the patient by means of his breath and also by the urine.

The application of topical remedies to the throat and nasal mucous membrane is frequently a matter of great difficulty in children, and much adroitness and firmness will be often required. In mild cases where there is only a slight congestion and swelling of the tonsils, no local treatment need be attempted, except perhaps the sucking of pieces of ice or acid milk. In older children the throat spray may be used if the patient is sufficiently docile, but young children are almost sure to offer a certain amount of resistance when their throat is being attended to, and under these circumstances spraying is useless, and the spray is rarely properly directed. Here mopping by means of a large paint brush or list secured at the end of a piece of stick will have to be resorted to. Syringing the fauces is also useful to clear away the mucus which is so apt to accumulate both in the fauces and nasal passages.

In selecting an antiseptic which is to be used freely as in syringing or spraying, it is well to remember that some of it may be swallowed, and consequently it should not be very poisonous, while for mopping or painting a caustic or more active poison may be used. In severe cases the frequent cleansing of the throat is a matter of great importance and one upon which we are inclined to lay much stress; it is, however, often attended with exhausting struggles for the patient, and can only be done by properly trained nurses, the friends rarely having the necessary skill or fortitude. The actual antiseptic selected is of less importance than the manner of using it, the object being to prevent the mucus and products of decomposition from accumulating in the fauces and being drawn into the air passages or being absorbed. For syringing or mopping, solutions containing chlorine, as hyp. soda chlorinate (1 to 20), sulphurous acid (1 to 20), boric acid (1 to 15), boroglyceride (saturated solution in glycerine), sanitas (1 to 40), permanganate of potash (1 to 40), answer very well. The sulphurous acid has the disadvantage of frequently containing sulphuric acid, and consequently giving rise to smarting if there are many cracks in the lips or excoriations about the nose. These can be used every four hours, or more frequently according to the severity of the case. When there is much exudation, or sloughing of the tonsils or fauces, some strong caustic solution, as glycer. acid carbolici, or chinolin 2 to 5 per cent. in alcohol should be employed. Nitrate of silver may be applied once or twice a day, having first syringed away the mucus; a saturated solution of salicylic acid is *sp. vini rect.* is a good preparation for painting on.

There is but little reason to believe that the course of the fever is much influenced by internal remedies; in mild cases a saline such as effluvie of potash is useful, giving it only in moderate doses, as 2 to 5 grs. every four or six hours; in larger doses it is apt to be deleterious. In more severe cases the treatment must be adapted to the symptoms, stimulants being usually required on account of the depression which is so often present. Carbonate of ammonia, digitalis, cinchona bark, separately or in combination, are the most useful drugs. Diarrhoea, if excessive, must be kept in check by opium

emelia; if moderate, it had better be left alone. Sleeplessness, headache, delirium, are best relieved by an ice bag to the head and full doses of hyoscin. We do not believe that bismuth of mercury or other mercurial salt is of the slightest use in modifying the severity of the attack. It has failed entirely in our hands.

When the temperature continues high, being 104° to 105° , quinine in 1 to 2 gr. doses, and repeated packs, so as to get the skin dry, have appeared to us the most useful form of treatment. The child should be wrapped up in a sheet wrung out of water at 60° and rolled up in a blanket for an hour. This must be repeated if the temperature continues high. Cold spongings are also useful. Cold baths require great care on account of the depression they are apt to produce; if used at all, they should consist of the graduated bath—that is, the child should be placed in a bath at 90° , the temperature being gradually reduced to 60° by the addition of cold water. Anti-febrile or antipyretic may be used, but their effect is temporary only, and they are apt to be accompanied by considerable depression of the heart. These drugs are too depressing for malignant cases. The former may be given in 3 or 5 gr. doses in sherry or tincture of orange peel, as it is insoluble in water. Oxygen gas has been used with advantage by Cresswell,¹ and we have been well pleased with it in some cases in which we have tried it.

It must, however, be admitted that the treatment of the severer forms of scarlet fever is disappointing and often disheartening; in spite of the most devoted nursing, stimulants freely given, antipyretics, liquid nourishment of all kinds, antiseptics to the fauces, they go from bad to worse, apparently un-influenced by all that has been done for them. On the other hand, it sometimes happens that cases which at first are most threatening are apparently saved by careful nursing and appropriate treatment, and this fact should encourage every effort. In rare instances sloughing fauces will heal, pneumonia clear up, temperatures which have been high for two or even three weeks gradually fall, and complete recovery ensue.

The stria which so commonly occurs is usually suppurative from the first, the typhoid membrane quickly gives way and a free discharge follows. Earache should be treated by the instillation of warm camelliated oil to which a drop or two of iodoform has been added, and hot fomentations may be applied externally. A single drop of glyc. acid. carbolici (B.P.), carefully dropped into the ear so as to reach the membrane, usually gives relief. If on examination with the speculum, pus is seen bulging the membrane, an incision should be made; but nature usually anticipates the surgeon in this matter, and so quickly that the operation is seldom necessary, except in those cases where the membrane fails to give way early. The pus which forms in scarlet fever appears to penetrate the membrane more quickly than the pus formed in septicæmic cases. When a discharge exists, care should be taken to keep the ear syringed out, and some antiseptic powder, such as iodoform and boric acid, blown in. The after treatment of otitis often need not be gone into here.

The preventive treatment of post-scarlatinal nephritis consists in the greatest care being taken during the second and third weeks to avoid cold and

to keep the skin acting, and to avoid a stimulating diet and any overfeeding. The child should be sponged daily or bathed, provided there is no risk of chill; the diet should be chiefly fluid, milk, light puddings and soups, and the bowels should be acted upon if necessary by laxatives or salines such as tannate of soda or Glaser's salts. On the appearance of a severe smart purge of serum or jalap should be given, and the child dressed in a flannel night shirt and placed between the blankets, salines such as citrate of potash, liq. ammonia acet., or tannate of soda, being given. The diet should consist entirely of barley water and of milk, or of any one of fluids. Hot packs, a blanket wrung out of hot water being used, or hot vapour baths given by means of Allen's apparatus, or warm baths, are always useful in acting on the skin and drawing away the blood from the kidneys, and in relieving the inflammatory congestion present. The smaller the quantity of urine passed the more vigorous should be the packs or baths. Ten grains of pilocarpine leaves, made into an infusion with hot water, or one-tenth of a grain of nitrate of pilocarpine subcutaneously, may be given before the packs once or twice a day. Children bear pilocarpine well, but its use requires care on account of the cardiac depression it is apt to produce. Poultices to the loins should be applied between the packs. Dry cupping seems sometimes to be useful and may be tried. If the kidneys fail to act, and no urine or only a small quantity is secreted, large amounts of warm water will sometimes give relief, urine being passed as the osmotic is being expelled.

During the course of a nephritis the condition of the heart must be carefully watched, as also any tendency to muscular twitchings about the face or hands. Any attacks of dyspnoea or evidence of cardiac dilatation must be met by the administration of digitalis, two or five drops every two hours. Solution of nitro-glycerine in drop doses, inhalation of chloroform, or nitrate of amyl may be tried if convulsions supervene.

Quarantine.—Six weeks at least—better two months—reckoning from the first day of the fever should elapse before a child convalescent from scarlet fever can be allowed to rejoin his companions or go to seaside lodgings; and not then if the desquamation is incomplete or there is a discharge from his nose or ears. In so important a matter as discharging a convalescent scarlet fever patient, it is wise to err on the side of caution.

Measles

Measles is an acute infectious disorder characterised by coryza and fever in the prodromal stage, followed by a peculiar papular eruption on the face and body.

Measles, like whooping cough, prevails in widespread epidemics, though its epidemics are of shorter duration; but sporadic cases are always occurring in large centres of population. This epidemic prevalence occurs in large cities every eighteen months or two years, though the epidemics differ very much in their extent and fatality. In these epidemics, when once the disease enters a household, or indeed a street or alley, hardly anyone escapes who is not protected by a previous attack, the sufferers in nearly all cases being young children; the older children and adults having suffered in pre-

virus epidemics. Communities removed from frequent contact with civilization, and where there has been no epidemic prevalent for some time previously, invariably suffer severely when the poison of measles is introduced, adults being affected as well as children. The most notable instance of this in recent times is the epidemic of measles in the Fiji Islands in 1875, which raged for four months, 20,000 natives dying out of a population of 150,000; equal to upwards of one in every four of the population, whereas in London in 1896, which may be taken as an average year, the deaths from measles were five in every 10,000 living (at all ages). The same violence of an epidemic may be seen in a lesser degree in populations more especially among children, in villages or isolated places where there has been no epidemic for some time previously. The susceptibility to measles is exceedingly great in unprotected subjects; thus Biedert,¹ in a small epidemic in an isolated village, found only 14 per cent. of the children who were unprotected escaped after being exposed to the infection. In the Faroe Islands under similar conditions only 23 per cent. and 1 per cent. escaped.² The same experience obtains in schools and in the wards of children's hospitals, where, if a child has been admitted incubating and remains till the rash appears, an epidemic follows, which it is difficult to stop until nearly all of the unprotected have been attacked. The epidemics are independent of season, and occur in winter as in summer.

The disease, like most other specific fevers, spreads by contagion, but the nature of this has not been satisfactorily determined, though micro-organisms have been obtained from the breath and secretions of patients suffering from measles by A. Ransome, Braidwood and Vacher, and Canon and Feltzke.³

We have repeatedly made cultivations of pus coed from the blood of patients with measles, and such can also be detected by staining a dried drop of blood.

The poison is apparently given off in the breath and other secretions, and may be conveyed to a distance by its adhering to the clothes or person of a nurse or others coming in contact with the sick. The infection, however, appears to be more definable or more readily destroyed than the poison of smallpox or varicella, as rarely if ever in our experience is it introduced into a ward, except by those who were admitted incubating, it being unlike variola or varicella poison in this respect, infection in the latter case appearing to be brought in by visitors. The infection is known to be given out from the patient very early in the attack—that is, from the first appearance of definite symptoms, as coryza and fever—but there is good reason to believe that Mr. Vacher is right in believing that measles is infectious during the incubative stage, as well as during the febrile and eruptive stages. Several instances which point strongly to this conclusion have come under our notice.

The mortality differs enormously according to the circumstances under which the attacks develop and also in different epidemics. In healthy children among the well-to-do class the mortality is practically nil; in the tubercular and wasted children to be found in workhouses, hospitals, and

¹ Conney, quoted by Calkins.

² *Laborant for Kinderkranken*, vol. xiv. p. 55.

³ *Medien, Paris*.

⁴ *Brit. Med. Jour.* April 25, 1896.

among the lower classes the mortality is enormous, no disease more certainly being attended with a fatal result. William Square places it at 20 to 30 per cent. of those attacked in crowded wards. Among dispensary patients the mortality generally amounts to 9 or 10 per cent. In our own dispensary, during the six years 1880-1885, 1,335 cases were treated, with 128 deaths, making a mortality of 9 per cent. Of the fatal cases 73 per cent. were under two years of age, and 9 per cent. under six months of age.

Second attacks of true measles are not uncommon. We know one family in which one boy has had a severe attack of measles four times, a boy and girl three times each, and our girl twice; all these attacks were severe. In many cases where there is said to have been a recurrence of measles, one of the attacks has no doubt been rubella.

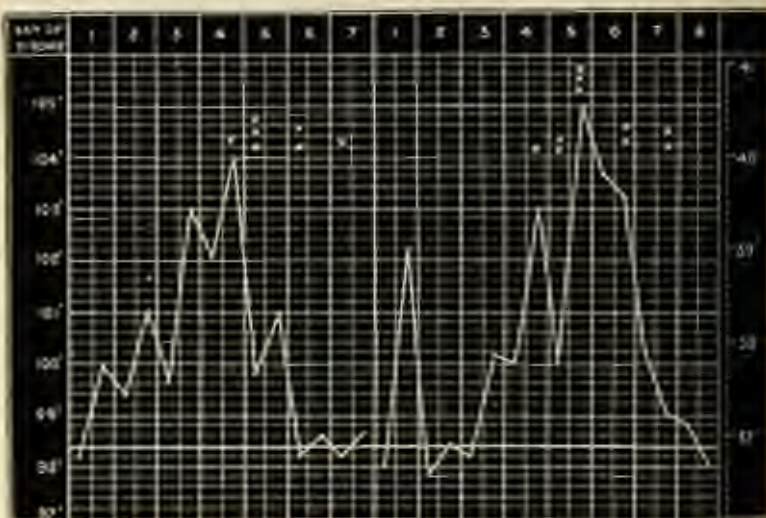


Fig. 42. Thermometer Chart of cases of Measles. *x*, rash present.

Infants are occasionally born with the rash of measles on them.¹

Inoculation.—When inoculated this appears to be seven or eight days, when contracted in the usual way it is mostly ten to twelve days, the rash appearing on the fourteenth or sixteenth day.

Symptoms. Prodromal Stage.—The early symptoms are those of a febrile cold. The child sneezes, waters at the eyes, there is catarrh of the nasal membrane, with usually a hard hacking or perhaps croupy cough. Sometimes the symptoms are those of a catarrhal conjunctivitis or blepharitis. On exerting the eyelids the palpebral conjunctiva is seen to be red and congested, and the lashes and tomia are hyperæmic with excessive secretion. The child is febrile, often acutely ill, the temperature rising in the evening a degree or two and usually falling again in the morning; this continues

¹ See Hild, *Medical Chronicle*, May 1846, and *Brit. Med. Jour.*, vol. i, p. 762, 1869.

though becoming increasingly marked till the rash is fully developed. Sometimes there is a mottled redness on the second or third day (see fig. 41). Often a blotchy redness about the face precedes the papular eruption. Eruptions occasionally occur.

Eruptive Stage.—The characteristic eruption usually makes its appearance at the end of the fourth day, on the forehead, face, neck, and trunk. The child's appearance at this time is so characteristic that in well-marked cases a glance is sufficient to establish the diagnosis. The face is flushed, the eyes red and watering, there is a sore cough, the forehead, nose, and cheeks are covered with crops of dusky red papules, surrounded by a zone of erythema which contrasts with the normal skin

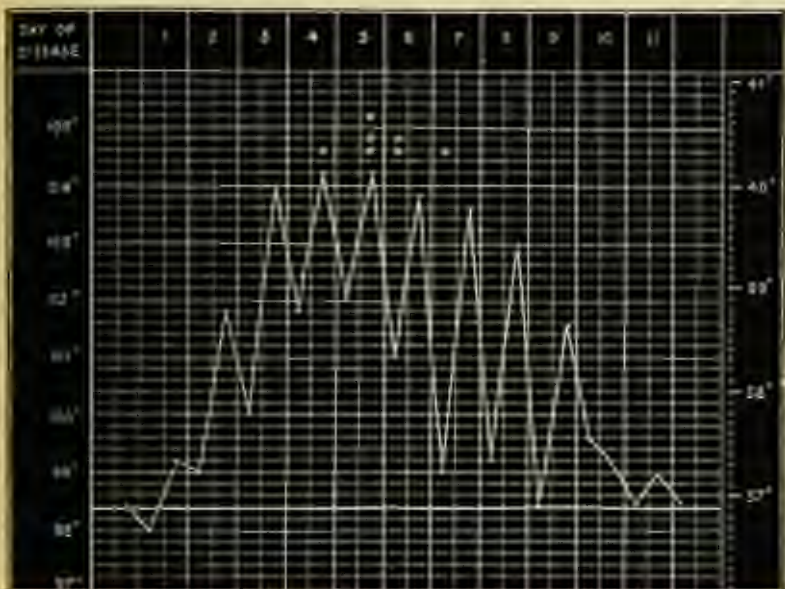


FIG. 43.—Temperature. Child of a case of Measles, complicated with bronchopneumonia.

between the groups. The papules can be distinctly seen and felt, and though not 'sherry' to the touch, yet they have often a distinct feeling of hardness. The rash on the face is usually both patchy and discrete, the patches being made up of confluent papules, the latter of small groups or single papules arranged at times in small crescents or semicircles. In the course of a day or two the rest of the body is more or less covered with the rash; it is apt to be confluent with such erythematous redness on the dependent surfaces, the extensor surfaces of the arm and thigh, the back and hamstrings, and more discrete or spotty on the chest and rest of the body. By the fifth or sixth day the eruption is at its height, and, beginning to fade first on the face and later on the body and limbs, is followed,

especially on the face, by a fine desquamation. By the seventh or eighth the rash has completely disappeared, leaving at most only an indefinite mottling or staining over the body. The temperature, which has probably reached 103° to 105° by the sixth day, quickly falls to normal or thereabouts, and the headache and discomfort are gone and the child seems greatly relieved. In severe cases in weakly children the crisis may be accompanied by much exhaustion, but this rarely happens. The temperature remaining high indicates some complication such as bronchitis or pneumonia (see fig. 45).

Mild or ill-defined Measles.—Very often all the symptoms are milder than those just described, but at the same time are perfectly characteristic. On the other hand, the attack may be so slight as to be recognised with difficulty. There may be almost an entire absence of symptoms in the prodromal stage, or a temperature only reaching 100° or 101° , the coryza and catarrh being insignificant, while the rash is represented by ill-defined and characterless papules about the neck, back of the hands, and thighs. In other cases probably the catarrh and laryngeal symptoms are well marked, the child evidently suffering from a laryngitis; this is followed by an indefinite mottling about the neck and hands as the laryngeal symptoms abate.

Severe and Complicated Measles.—Epidemics of measles differ greatly in the severity of the individual attacks. Most of these fatal attacks are characterised by high fever, dry brown tongue, delirium, and convulsions, due to an intense hyperæmia of the internal organs, more especially the lungs and brain. The heart's action is depressed, the rash ill defined, the skin dusky, and in worst cases markedly petechial. In such cases death may take place on the third or fourth day, or improvement may commence at the end of a week. In the majority of cases measles threatens life through the tendency to inflammation of the lungs. The lung symptoms may be prominent from the first, or the presence of pneumonia may delay convalescence or supervene when the acute symptoms have passed away. In the former case the symptoms are those of acute broncho-pneumonia, the temperature continues high, perhaps 104° or 106° , there is marked dyspnoea, wheezant sounds are heard over the whole chest, the air does not enter the lungs freely; the rash is scanty, perhaps only an ill-defined mottling; delirium followed by coma comes on; the eyelids become glued together with thick semi-purulent secretion, sandles appear on the mouth, the tongue is brown and dry, and unless improvement takes place the child sinks.

Catarrhal or Membranous Laryngitis is not uncommon in the pro-eruptive stage, or as the eruption is receding. Tracheotomy may be required if the obstruction to respiration becomes sufficient to threaten life, but it must be borne in mind that an amelioration of symptoms generally takes place when the rash appears. In these cases attended with membranous exudation the laryngitis generally follows rather than precedes the eruption. **Ophthalmitis** frequently occurs in anæmic and unhealthy children; corneitis and corneal ulcers may also be met with. **Glandular enlargements** may develop, the deep cervical gland being especially involved, as in scarlet fever; abscesses are not common. **Otitis** is very common during convalescence, suppuration taking place in the middle ear and the membrane becoming perforated. **Diarrhoea** is not an uncommon complication or sequela, especially during the hot weather, though by no means exclusively

se; it is apt to become dysenteric in character, mucous, bloody, and hard stringy faeces being passed, with prolapse of the bowel.

The health often remains impaired for a considerable time after an attack of measles; it is during this stage that **Acute Tuberculosis** and **Cancer** **aris** may arise. The tuberculosis very frequently appears to take its rise from enlarged and cheesy bronchial glands.

Diagnosis.—The disease most likely to be mistaken for measles is rubella, the latter disease closely resembling mild measles. (See RUBELLA.) A nearly rash is sometimes present in cases of septicæmia, where there is separation as in empyema.

It is possible to confound measles with smallpox, though this difficulty is more likely to arise in the case of adults than children. According to Collic there are two kinds of smallpox which it is possible to confound with measles, viz. the commencement of a confluent case and the commencement of a hemorrhagic case. The papules in smallpox are much harder and more shotty, and, moreover, in a confluent case, the headache, lumbar pain, and general symptoms would be more severe. Hemorrhagic measles is very rare, and, according to the same author, would be difficult to diagnose from black smallpox; the quantity and quality of the vaccination marks should be taken into account.

Morbid Anatomy.—There is not much to be said under this head, inasmuch as there are no *post-mortem* appearances characteristic of measles, the principal lesion found being catarrhal pneumonia; the whole of the internal organs are gorged with blood, and minute hemorrhages are present on their surfaces. The mucous membrane of the bronchi is intensely congested, the surface of the pleura roughened and perhaps covered with lymph, one or both lungs being solid from catarrhal pneumonia; in such case the pneumonia resembles that found in septicæmia. In some instances crepous pneumonia involving a lobe or portion of a lobe may be present, or there may be patches of crepous pneumonia. At other times there is mucous bronchitis, with patches of catarrhal pneumonia and emphysema. In all cases of pneumonia following measles which we have examined microscopically we have found obvious exudation in the air vesicles, in spite of the pneumonia being apparently of the catarrhal variety.

The following *post-mortem* record taken from one of our note books illustrates a malignant case:—

Measles, malignant case. Death—Child of eleven months; death on fourth day. On examining lungs it is noted that the upper lobes are emphysematous on their surfaces; in the lower lobes emphysema alternates with collapse; on section there is intense induration of the trachea and bronchi, yellow serum exudes from the minute bronchi; the lungs are intensely congested, there are patches of lymph pneumonia in the lower lobes.

Treatment.—No very active treatment is needed during an attack of ordinary severity, but much may be done to promote the patient's comfort and to prevent any complications. He should, of course, be confined to bed as soon as measles is suspected, the temperature of the room being maintained at 65° F., and if the cough is hard and irritating a steam kettle should be called into requisition to keep the atmosphere moist. The diet should consist of milk diluted with barley water or seltzer; in mild cases soup or light

puddings may be allowed. Demulcent drinks, such as barley-water, lemonade, black-currant or tartarian drinks or jellies, are useful in allaying the irritating cough. Frequently sponging with warm water containing a weak solution of tar or 'sassafras' relieve the itching and help in bringing out the rash. During the pro-scrptive stage, when there are high fever, restlessness, cough, and frequent pulse, small doses of *m. scrofa*, one or two drops every two hours,—carefully watching the effect, especially after five or six doses have been given—will be usually attended with relief. Jelly containing cod-liver oil or small doses of Dover's powder may be given to relieve the cough. Great care should be exercised during convalescence to prevent catching cold, especially in those who are liable to bronchial catarrh, as the bronchial mucous membrane remains for some time in an irritable condition, and exposure to cold is exceedingly likely to give rise to bronchitis or diarrhoea.

In cases of greater severity, especially those in small children which are accompanied by a starry rash, congestion of the internal organs, high temperature, and broncho-pneumonia, active treatment is required. It is necessary to get the skin to act efficiently and thus relieve the congested internal organs; to this end rapid sponging, hot packs, or mustard baths may be employed. For children under two years of age the mustard bath is the most suitable; the child being placed for three minutes in a bath of 100° F., one table-spoonful of mustard to the gallon of water being about the proper strength. The child must be quickly dried and put between blankets; the bath may be repeated in a couple of hours if necessary. The stimulating effect of the bath upon the skin is often of great service. Linseed poultices to the chest are to be avoided in the case of young children, unless the attendants are trained nurses; hot fomentations or bean poultices are preferable in despondent patients and in the hands of the unskilled, as being less heavy.

In older children the hot pack is to be preferred to baths. In the early stages small doses of antimony, pot. ant. tart. $\frac{jss - \mathfrak{ss}}$ of a grain, with some tannated soda or citrate of ammonia, should be given every three or four hours, but omitted if there is nausea. Acetate may be useful, but it must be carefully watched, on account of the depression it is apt to produce if pushed too far. Alcohol in the form of whiskey or brandy should be given if the pulse is small and rapid and the tongue dry and brown. If the cough becomes loose and there is excessive secretion from the bronchi, ammonia, digitalis, and alcohol in combination should be given. The eyes, nose, and mouth in severe cases require attention; they should be washed or nipped out with warm water; if there are any aphthous patches in the mouth some lozenges or dilute glycerine should be applied. Otitis and glandular inflammation may require attention. During convalescence no medicine answers better than nitric acid and bark.

Quarantine.—How long should quarantine be maintained in a case of measles? This is not an easy question to answer, though it is certain that the infection is not given off from the patient for so long a period as is the case in scarlet fever. In uncomplicated cases hot baths may be given as the rash begins to disappear; they are useful to cleanse the skin and render the patient more comfortable. It is well for the patient to keep his bed for ten days and his room for three weeks; then, if he is quite well in every respect, there can be little danger in his mixing with his fellows. When a case of

measles occurs in a house, it is necessary for the other children who have not had it to stop going to school or mixing with other children, as it is probable they will have contracted the disease; and as measles is infectious in its early stages—if not during the incubation period—they may readily be the means of going it to others. For the same reason it is unwise to send them away from home, though care should be taken that they do not come in contact with the patient at home. The bedding should be soiled and the room occupied by the patient disinfected at the conclusion of the illness.

Rotheln or Rubella

Rubella¹ is an infectious fever closely resembling but distinct from measles; it is for the most part a milder disorder than measles, and does not protect from it. In some epidemics it closely resembles mild scarlet fever.

Etiology.—The resemblance between these two diseases is unquestionably a close one, and there is little doubt that not infrequently—epidemics of rubella—or at any rate sporadic cases—are mistaken for measles. It has, however, been clearly shown by those who have had the opportunity of watching successive epidemics of infectious diseases in schools and asylums, where the same individuals have been attacked, that rubella does not protect from either measles or scarlet fever, nor do attacks of the two latter afford any immunity from attacks of rubella. The resemblance, and yet the difference, between the two diseases is well put by Dr. West when he says 'they resemble each other somewhat as varicella and variola—alike, but not the same—not twin sisters indeed, but half-sisters at any rate.' That they should be confounded in practice is not surprising, especially when we remember that measles is sometimes an extremely slight disease and the rash by no means characteristic. In mild attacks of measles the corpus is usually slight or absent, and the rash little else than ill-defined mottling.

Rubella occurs in epidemics, sometimes being prevalent and widespread, as it was in this country during 1880; at other times sporadic cases crop up and there appears but little tendency for the disease to spread. As a result, rubella has earned a different character as regards contagiousness from different writers who have observed it, some maintaining that its contagiousness is almost nil, and others that it is extremely contagious. The truth is that susceptibility to its influence seems to vary strangely at different times and in different places in a way which it is difficult to account for. Thus in one locality there may be an epidemic prevalent; an individual goes to another while incubating, he suffers from an ordinary attack and the disease does not spread, though he comes in contact with many individuals. There is little doubt, however, that rubella has been confounded with some of the non-specific, non-contagious forms of measles or rose rash. Age does not seem greatly to influence predisposition; infants, children, and adults suffering alike; indeed, in some epidemics adults suffer more in proportion to their numbers. Thus in an epidemic in the Children's Hospital observed by Dr. Hurry and ourselves, out of twenty-seven cases, eight were those of lady probationers or 'nurses,' and nineteen of children; so that the adults suffered far more

¹ We adopt the term *rubella* as first suggested, we believe, by W. Sydenham. 'Epidemic measles,' which has been proposed, introduces the ambiguous term of 'measles.'

largely in proportion to their numbers, though there can be no doubt that the nurses care is contact with those suffering from the disease much more than the children. Considering how much sorer a disease rubella is than measles, it would appear that a smaller number of individuals who are unprotected by a previous attack are susceptible to its influence.

The relationship of rubella to measles and scarlet fever is an interesting question, and while very few believe it to be a hybrid disease, the attack resulting from the reception by the patient of both scarlatinal and measles poisons, yet, considering the close resemblance which it bears to measles, there is nothing inherently improbable in the idea that the resemblance is something more than coincidental, that the poisons may have been derived from one another or from the same stock at some distant epoch, and have become modified by being cultivated under different conditions. It is interesting to note that some observers assert that the character of an epidemic becomes modified in the direction of either measles or scarlet fever if either of these is prevailing at the same time.

It is a curious fact that there are epidemics of rubella, in which the rash closely resembles scarlet fever and red measles, as is generally the case. Whether the two forms are distinct diseases or only varieties of the same disease, it is impossible to say. We cannot say whether the measles variety protects from the scarlatinal variety.

Incubation.—There has been some uncertainty about the length of the incubation period. The common period is from two to three weeks, as observed both by W. Squire and Lewis Smith. In three cases coming under our own observation the time appeared to be sixteen, seventeen, and eighteen days respectively.

Prodromal Stage.—In children, as a rule, no prodromal symptoms are observed, the rash being the first thing to be noticed. In adults who are able to describe their feelings, complaint is made of weariness, headache, and lassitude for twenty-four hours before the appearance of the rash. There may be vomiting, coryza, slight sore throat, or a tingling sensation of the skin of the face. Another noteworthy symptom sometimes present is the enlargement of the superficial lymphatic glands situated along the posterior edge of the sterno-mastoid, or the submaxillary and occipital glands are tender as well as slightly enlarged, and give rise to a certain amount of stiffness of the neck. On the other hand, it is by no means uncommon even in adults that the discovery of a rash is the first thing to call attention to the attack.

Prodromal Stage. Measles variety.—The rash usually appears first on the face, and consists of indistinct, ill-defined papules, forming irregular patches of a rose-red colour, which shade away into the colour of the skin; there may be simply erythematous blotches. The patches of confluent papules vary much in size and shape, many perhaps consisting of only a few papules grouped together; sometimes, on the contrary, the whole face is of a red colour. The rash is usually also abundant on the neck, chest, back, buttocks, and flexor surfaces of the arms and thighs; in these situations it is usually less confluent and patchy than on the face, the rash consisting of groups of papules or of single papules. Occasionally the confluent of the papules and the erythema which surrounds them give rise to the stupor

of scarlet fever, especially in that form in which the rash is patchy on the limbs, but the rash of rubella always consists of papules, and is not diffuse or pustular as is the rash of scarlet fever. Rubella rashes undoubtedly vary considerably, especially in the confluence of the papules; as a rule, the colour is of a rose-red when it first comes out, being of a brighter colour than measles; the papules do not so constantly arrange themselves in crescents, and they are less distinct than the measles papules. The rash is usually most intense on the second day, but remains visible for three or four days; by the end of this time it has mostly faded, often leaving more or less staining of the skin and a light brassy desquamation. The rash frequently gives rise to much itching. Sometimes the axillary and inguinal glands become enlarged.

The course of the attack may be feverless, though usually there is a slight rise of temperature, the highest being on the second day, 99° to 100° ; in rare cases it reaches 102° or 103° . The temperature becomes normal as the rash disappears.

Hyperemia of the conjunctiva and fauces exists in many cases, but it is rarely as marked a feature of the attack as it is in measles. Sometimes a dryness and soreness of the throat in swallowing is complained of, with more or less catarrhal tonsillitis.

While such may be taken as a typical attack, it must be acknowledged that the attacks of this exanthem vary greatly in intensity, and the rash may be too ill defined to admit of a positive diagnosis. In some rare cases, such as those described by Dr. Cheate, the course of the disease is that of a serious illness, with marked implication of the larynx and bronchi, the cough being incessant and crouplike. In two of these broncho-pneumonia supervened, in several others catarrh was a prominent symptom. On the other hand, cases may occur of the mildest form, so wanting in character both as regards rash and coryza, that they may be looked upon as of a doubtful nature and perhaps forgotten, and only when they are succeeded by more typical cases does their character become clear.

Scarlatinal variety.—Some years ago we were much puzzled by finding that a number of what were apparently mild cases of scarlet fever, when admitted to our fever ward developed scarlet fever a few days after their admission. Shortly after we noted a number of patients coming to the out-patient department with diffuse red rashes, but who were hardly ill at all, but had been brought on account of the rash. It soon became apparent that there was an epidemic of a disease closely resembling scarlet fever yet distinct from it, inasmuch as it left the patient still susceptible to an attack of scarlet fever. This epidemic was no doubt one of the scarlatinal variety of rubella. In many of the cases there was a history of vomiting as an initial symptom, complaint of sore throat, slight fever, and a very well-marked rash, while the child hardly felt ill at all. The rash was usually copious and could not be distinguished from scarlet fever rashes, but was more of a rose tint and less distinctly punctiform in character—that is, there was a uniform redness, without the red points, which correspond with the hair follicles, being well marked. Still, we must admit that the rash seen in these cases was indistinguishable from some unobjectionable scarlet fever rashes.

When once such an epidemic is known to prevail the diagnosis ceases to be difficult. The fever, malaise, and sore throat are slight, while the rash is copious. In scarlet fever with a copious rash the fever is usually high, the tonsils are angry and swollen, and the child is evidently ill. Mild cases would not be likely to occur one after another; some would be certain to be sharp and typical. Desquamation follows the red rash of rubella, but it is rarely as well marked as in typical cases of scarlet fever, where the rash has been copious and the fever sharp. Some writers lay great stress on the enlargement of the lymphatic glands behind the sternum mastoid, axilla, and inguinal region. This is no doubt true, but they are not universally enlarged; we have certainly seen cases of both varieties of rubella without any lymphatic enlargement. In some cases and in some epidemics the rash is more papular than the rash described, but we have not seen many such. It must be borne in mind that the scarlatinal variety of rubella is a comparatively rare disease, while scarlet fever is a very common one, and that an isolated case of fever with sore throat and a diffuse red rash is far more likely to be scarlet fever than rubella, however mild and uncomplicated it may prove to be. To find that a child we have declared to be suffering from 'German measles' has acute nephritis is, to say the least of it, an unpleasant discovery.

Rose rashes, diffuse and patchy, may make their appearance after the ingestion of some improper food, or in hot summer weather. There is usually an absence of both sore throat and fever. The possibility of a red rash being due to belladonna must not be forgotten.

Complications and Sequelæ.—There are usually none; in the more severe cases catarrhal disorders, such as coryza, tonsillitis, and laryngo-bronchitis may complicate and succeed the attack. The prognosis is favourable; the disease is probably never fatal in healthy children; in epidemics in hospitals, where it attacks children already suffering from and much reduced by pulmonary affections, it has appeared to be the immediate cause of a fatal result. Even in healthy children the health may remain below par for some time afterwards.

Diagnosis.—Rubella may at times be mistaken for some of the anorectal erythematous or infectious rashes from which children suffer from various causes, especially indigestible food, but there is usually no fever. In single cases diagnosis may be difficult, but the fact that rubella prevails in epidemics often assists in making a diagnosis. The diagnosis between measles and rubella in an individual case is at times impossible; often it is difficult, inasmuch as it must be admitted that there is no one characteristic symptom of rubella, and moreover the rash differs in different cases. The differences between typical cases of rubella, measles, and scarlet fever are shown in the table opposite.

Treatment.—Every case of rubella and every suspicious case should be carefully isolated, and confined to one room, if not to bed. The diet should consist largely of fluids and solids. A simple saline such as citrate of potash may be given, and other symptoms must be treated as they arise.

Quarantine.—The patient should be isolated for at least three weeks; better if four weeks elapse before he is allowed to rejoin his companions.

	RHETIC	MEASLES	SCARLET FEVER
Incubation. Preceding by Prodromal symptoms.	14 to 21 days. 1 day. Often none. Sometimes enlarged glands, weakness and slight fever.	8 to 12 days. 3 to 4 days. Sore throat, cough, headache, coryza.	2 to 3 days. 1 day. Vomiting, headache, sore throat.
Tumors.	Slight swellings.	Usually none.	Tonsillitis well marked.
Rash.	Appears on the first or second day. Consists of indistinct papules of a rose-red color confined to the face, usually extends on the hands, buttocks, and thighs. Often fades from the face before it is fully developed elsewhere. Often much itching. In the scarlet fever the rash closely resembles scarlet fever. It is rose-red, diffuse, less markedly punctiform than typical scarlet fever.	Appears on the fourth or fifth day. Consists of confluent papules of a dusky red color on the face, and groups of papules often in a circular line lower on the trunk and limbs.	A diffuse punctiform red rash covers every neck, trunk, and limb—may be patches on the extremities.
Desquamation.	Desquamation absent or only very fine branny scales.	Desquamation absent or only in fine scales.	Desquamation usually seen.
Temperature.	Often normal throughout, rarely above 100° F.	Fever always present, sometimes high, reaches its maximum when the rash is fully out, then falls.	Fever always present, usually high, disappears as the rash fades.

Diphtheria

Diphtheria is an infectious disorder which is characterized by the formation of a fibrinous exudation on mucous surfaces, caused by the development of a peculiar bacillus; it is usually accompanied by toxæmia and albuminuria, and frequently followed by paralysis of various muscles. At the very threshold of the subject it may be as well to attempt to clear the ground by asking—Are we to consider all fibrinous exudations which have the characters of a 'false membrane' as evidence of the presence of diphtheria? Is diphtheria always accompanied by a 'false membrane'? Both these questions must be answered in the negative. Recent observations clearly show that other micro-organisms besides the D-bacillus are capable of producing fibrinous exudations on the fauces, and, moreover, the D-bacillus has been demonstrated in the secretions taken from what were apparently non-membranous sore throats. Still, we must admit that membranous exudations are usually diphtheric, and that diphtheria is rarely present in the absence of 'false membrane.'

That diphtheria is a highly contagious disorder is made certain by very definite evidence; it is a matter of common experience that the disease passes from patient to nurse, from one patient to another in the wards of a hospital, and from a sick child to its playmates or parents in private houses. It is certain also that the infection can be conveyed from the sick to the healthy by means of a third person, the infective particles travelling on the clothes or on the hands of the latter. Direct inoculation has taken place accidentally by means of small pieces of membrane or the scissors entering the mouth, as in sucking a tracheostomy wound; false membrane has formed within twenty-four hours of an operation at the seal of the wound. There is little doubt also that the disease has been transferred from animals to man through direct contact or by means of milk from cows suffering from the disease. The D-bacillus may retain its vitality for many months outside the body, and may be carried any distance in clothes, bed linen, or in surgical instruments. It is possible that the D-bacillus may grow and develop in sewage, in cesspools, and drains, and re-enter the body by the inhalation of sewer gas. It is a popular notion that there is a close connection between diphtheria and sewer gas, and sanitary faults in houses are frequently credited with being the cause of outbreaks of diphtheria; and it is quite possible that sewer gas may give rise to a non-specific sore throat which may form a suitable soil for the development of the D-bacillus.

Diphtheria occurs as epidemics, but it is also endemic in some cities and rural districts. It is constantly present in such cities as Berlin, Paris, and New York, and in some rural districts in this country. In its dominion and in the varying character of its epidemics it is one of the most mysterious diseases with which we are acquainted, and there is much about it which requires continued investigation. In this country until recently it has been more common in the rural than in the urban districts, though it appears at the present time to be more common now in our large towns than formerly. It is especially prevalent in the south-eastern and eastern rural districts, while some others appear to escape almost entirely. It makes its appearance at times in isolated farmhouses, or villages remote from other habitations, and this circumstance has suggested the idea that possibly the infective particles have been conveyed thither by means of the wind (Airy). It has occurred in Central Africa far away from any source of infection. But in connection with these singular cases we must remember that the D-bacillus retains its vitality for many months under suitable conditions, and may be conveyed any distance on clothes or other articles, and thus infect persons long distances away from the original source of the infection.

No age is exempt from its attacks, but children between the ages of two and eight years are most often attacked, and children of these ages most readily succumb than do older children. The disposition to diphtheria seems to run in families, members of the same family being attacked in quick succession or at variable intervals.

The parts which are most often attacked are the fauces, nasal mucous membrane, larynx and trachea, glans penis and vulva; or, may be, some wound or excoriated skin. The bacillus enters the mouth in either air or food, and if conditions are favourable for its development the growth of the bacillus commences, and membrane forms on the tonsils and soft palate.

In what these formidable conditions consist it is difficult to say. Certainly a slight croup throat or laryngeal catarrh often precedes an attack of diphtheria, and it is very probable that any injury to the epithelium or a catarrhal state may afford a suitable soil for the development of the bacillus. We have known instances in which nasal diphtheria has supervened in a case of chronic sinusitis, while other children exposed to infection at the same time were not attacked. The fatality of different epidemics varies strangely: sometimes whole families are swept away, as in the epidemic described by Trouessart in Sologne, where in one farm, where the residents numbered eighteen, only two, the father and a servant girl, survived. The infection seems to vary in intensity, at times and under certain conditions becoming attenuated, at other times resuming its virulence.

Morbid Anatomy and Pathology.—The membranous exudation which is present in diphtheria is of a whitish-grey colour, and when first formed is firmly adherent to the tissues beneath it. It is in some cases rather yellowish than white; in malignant cases it is frequently brown from being stained by broken-down blood. In a few days more or less the membrane becomes loosened from its attachment and can be removed by means of a brush: if forcibly removed it leaves a raw surface, which quickly becomes again covered with membrane. Speaking generally, membrane adheres more firmly and is less easily detached from the mucous membrane of the tonsils and soft palate than from the larynx and trachea. If a thin section of a piece of membrane adhering to the soft palate be stained with methyl blue, and examined with a moderately high power, it will be seen that the membrane consists of a fine network of fibrin with epithelial cells and leucocytes in the meshes; beneath the membrane the papilla and connective tissue of the deeper layers of the mucous membrane will be seen to be infiltrated with leucocytes. On the surface of the fibrinous exudation many cocci of various kinds are visible, such as are commonly to be seen in the mouth or alimentary canal. Loeffler's D-bacilli are to be seen usually in little balls or masses embedded in the superficial layers of the false membrane; in some cases they may be seen in the deeper part of the membrane or beneath it. Unlike the anthrax bacillus, the D-bacillus remains local, and does not penetrate into the tissues or enter the blood. The D-bacillus is a non-motile little rod about the length of the tubercle bacillus, but thicker, so that when several are joined together they look at first sight not unlike streptococci. When fully developed the ends of the bacilli are darker and thicker than their central portions, sometimes only one end is enlarged. Two are often joined together, but not infrequently more. They vary considerably in shape and size, according to their age and the conditions under which they have grown. The chemistry of the membranes and the poisons formed in the exudations and in the blood have been studied by Reus and Yersin, and more recently by Sidney Martin (*Lancet*, March 26, 1902). The latter observer has established the fact that during the growth of the bacilli a ferment is formed which is capable of digesting proteins, certain albumoses being formed which act as virulent poisons on the system. These albumoses are formed locally and are then absorbed into the blood; but it appears the ferment is also present in the blood, and by its action on the proteids of the blood and tissues albumoses may be formed in the spleen

and other organs. Similar poisons are formed when the bacilli are cultivated in blood serum as in gelatine. Roux and Yersin have shown that if the serum fluids in which the bacilli have grown are, after the bacilli have been separated by filtration, injected subcutaneously into guinea pigs, death takes place with symptoms of typhoid in twenty-four hours. If small doses were employed and injected into rabbits, and a fatal result did not take place, a paralysis was often left. The poison appears to give rise to degeneration of the tissues; there are changes in the liver cells, the muscular fibres of the heart and other organs, and the smaller motor and sensory nerves. In the peripheral nerves the white substance of Schwann undergoes degeneration, and in places disappears; the axis cylinder is also affected, but in less degree. It is this peripheral degeneration of the nerves which is the cause of the paralysis so often noted after an attack of diphtheria. The blood is profoundly altered and its coagulability interfered with; hence the hemorrhages and purpuric condition seen in malignant cases of diphtheria. The cause of the albuminuria is uncertain; it may be caused by the altered state of the blood, or be due to the fatty degeneration which the renal epithelium undergoes; the amount of albumen present is in most cases a correct index of the severity of the attack.

From the above facts it would appear that the D-bacillus is the primary infective agent, and that during its growth it gives rise to the fibrinous exudation; at the same time a ferment is formed, resembling pepsin which is capable of digesting proteids. This proteid digestion goes on both in the membranous exudation and also in the blood, albumoses being formed, which play the part of virulent poisons, giving rise to rapid tissue degeneration and serious changes in the blood. The relation between the diphtheria of man and that of the domestic animals is interesting and important. Some of our domestic animals appear to suffer not infrequently from diphtheria, and may be the means of giving rise to epidemics of human diphtheria. The observations of Klein¹ have shown that diphtheria may be communicated to cows by subcutaneous injections of filtrations of bacilli from the membrane taken from cases of human diphtheria. A soft tender swelling forms at the seat of the injection, and in some cases at least a number of pimples appear on the udders, which pass through the stages of pustules and ulcers. The cows suffer more or less from fever, and an extensive loss of hair takes place. During the eruptive stage the milk of some of the cows was found to contain numerous diphtheria bacilli. In at least two epidemics of diphtheria in which the milk coming from a certain dairy was suspected of being the cause, it was found on examination of the cows that they were suffering from an eruptive disorder on their udders similar to that produced in those cows which had been inoculated. Diphtheria has been produced by Klein in calves by feeding them with cultures of the D-bacillus in milk, and epidemics of diphtheria have been observed in cats. Guinea pigs are the most susceptible of all the domestic animals. Fowls suffer from membranous croup which closely resembles, if it is not identical with, human diphtheria.

Pharyngeal Diphtheria.—The tonsils, uvula, and pillars of the fauces are the favourite sites for the false membrane in diphtheria, and in by far

¹ Twentieth annual report of the Local Government Board.

the greater number of cases occurring in practice these parts are affected in the first instance. The attack, unlike scarlet fever, usually begins insidiously. The friends notice that the child is ailing; it does not care for its toys, it is peevish and fretful, and towards evening is feverish. Perhaps there is some glandular enlargement at the angles of the jaw, or a discharge from the nose, or the child is heavy and drowsy. In other children there is usually some complaint of sore throat or difficulty in swallowing; the child feels cold and shivery, and sits over the fire trying to keep itself warm. An examination of the fauces, if made within a few hours of the first symptoms, may show nothing very distinctive; there may be some swelling and excessive redness, with some whitish or yellowish exudation in points or patches, but it may be quite impossible to decide whether the case is one of diphtheria, scarlet fever, or other form of tonsillitis. Usually, however, within twenty-four hours of the commencement of the illness, patches of membranous exudation may be seen on the inner surfaces of the tonsils or soft palate; these are whitish or grey and opaque, adhering firmly to the surface so that they cannot be removed by brushing. If removed by forceps, a raw bleeding surface is left; a piece of membrane when removed is seen to be tough and firm, differing from the soft cheesy material which is present in scarlet fever or tonsillitis. The temperature is rarely high, being usually 101° to 103° F.; the evening temperature being, as a rule, a degree or two higher than the morning temperature. In a day or two, if not from the first, membranous exudation may be seen on the uvula or the pillars of the fauces, though the tonsils may be from first to last the only part affected. The nasal mucous membrane is apt to join in the inflammatory process; a semi-purulent, often bloody discharge makes its appearance at the nostrils; the child makes a snoring noise when asleep, on account of the obstruction caused by the swelling of the mucous membrane and the excessive secretion. An examination of the urine during the first day or two may be negative as far as albumen is concerned, but if a daily examination be made, in the great majority of cases albumen varying in amount from a trace to one-half will be found. During the next few days fresh patches of membrane make their appearance on the fauces, the older ones becoming loosened, then detached, by the process of sloughing which goes on. In the meantime the glandular enlargement and tenderness become more marked, and the neck is stiff and all movements are painful. The patient becomes weak, inert, and easily exhausted; there is often marked flutter of the breath. In favourable cases, after the first few days or a week no new membrane forms, while the old patches disappear, the swelling of the glands and tonsils becomes less, and the temperature gradually falls. The albumen also gradually diminishes in quantity and finally disappears. The child remains weak for a long time, convalescence being only slowly established. On the other hand, in unfavourable cases, instead of an improvement taking place at the end of the first week, the symptoms both local and general become more pronounced; the amount of urine increases, the pulse is weaker and perhaps intermittent, the anæmia is profound, the breath very offensive, and coagling of blood takes place from the mouth and nose. The patient gradually becomes exhausted and refuses his food. During the last hours of life there may be total suppression of urine, drowsiness, and extreme depression of the heart's action.

Mild cases may occur in which both the local and general symptoms are slight. There may be membranous or yellow-coloured patches on the nostrils, the nasal mucous membrane remaining free and the glandular enlargement absent, and perhaps only a trace of albumen in the urine. Such patients may be seen running about with but little appearance of illness; the local lesions may disappear in a few days. It is important to remember that in such cases paralysis may follow, or a fatal result may come about through cardiac failure.

Malignant Diphtheria.—Of severe and malignant cases of diphtheria there are several types. The attack may begin insidiously with a day or two of slight illness, and then alarming symptoms of cardiac failure may set in without there having been any excessive local lesions. In other cases the attack is more from the very first, perhaps accompanied by vomiting, and closely resembling scarlet fever in its mode of attack. Within a few hours of the onset there is extensive swelling at the angles of the jaws, with a feeling of stony hardness; a foetid, sanguineous discharge issues from the nostrils, and it is difficult to get a view of the throat in consequence of the swelling and difficulty in opening the mouth. The tonsils are so swollen as to meet, the uvula and soft palate inflamed and covered with more or less doughy-looking membrane. The temperature is usually high, being 103° to 104° F., and the pulse and heart's action exceedingly feeble. In the course of a day or two, sometimes less, the collaritis extends, the cheeks and face become inflamed, and the skin pits as low as the clavicle, or even over the sternum and chest walls; the patient becomes drowsy and cyanotic, and there may be an erythematous rash, especially about the neck and chest. Purpuric rashes are common in malignant cases. Death usually occurs in a few days. Such cases resemble malignant scarlet fever, and it may be difficult or impossible to distinguish between them in the absence of a characteristic rash.

Nasal Diphtheria.—In pharyngeal diphtheria the inflammatory process is apt to spread to the nasal mucous membrane, especially in severe cases. In some cases, however, the nasal mucous membrane is the first seat of the infection, and it may never spread to the tonsils, though it is usually so be found to involve the back of the soft palate and the pharynx more or less. In nasal diphtheria no membrane may be distinguished during life; there may be only a purulent discharge with blood, the presence of which in the nasal passages obstructs respiration, giving rise to a bubbling or sniffling sound, especially during sleep. In nasal diphtheria the general symptoms are usually quite as severe as in faucal diphtheria, and a guarded prognosis must always be given. In cases in which the soft palate, tonsils, and nasal mucous membrane are involved, the general symptoms, including the depression and also the albuminuria, are well marked. In connection with this form of diphtheria we must bear in mind there is a form of membranous exudation occurring on the nasal mucous membrane in measles and as a primary disease which is not diphtheria, but which runs a much more favourable course, and in some cases at least the membrane formed is thinner and less adherent than it is in diphtheria. The term '*Rhinitis fibrinosa*' has been applied to these cases. In all cases in which a child is febrile with a discharge from the nostrils we should be exceedingly suspicious of diphtheria, especially if an epidemic prevails at the time. The

inflammation may spread from the nose to the conjunctiva, and membrane may form on the palpebral conjunctiva and much purulent discharge may ensue, while the eyelids may be much swollen. Membranous conjunctivitis is not usually diphtheritic, but due to some local irritative process; the local disturbance may be severe, while the constitutional symptoms are slight.

Laryngeal Diphtheria.—The larynx may be the seat of the local manifestations of diphtheria in the first instance, or may become involved secondarily to the fauces or other part. The child may in the first place suffer from sore throat and feverishness for several days, and then a metallic cough and some dyspnoea will suggest the onset of laryngeal complications. Less often some other part is the first to be involved; thus we have known a patch of membrane to make its appearance at the seat of an eczema, and then a few days afterwards a diphtheritic laryngitis supervene. We have already described (p. 102) the symptoms present in laryngeal diphtheria. We must constantly bear in mind that the obstruction to the air passages caused by the presence of membrane in the larynx or trachea may modify or overwhelm the symptoms of the disease, but we must not overlook the tendency to heart failure or the depression, as well as the possibility of uræmia or paralysis supervening.

Wound Diphtheria.—Diphtheritic membrane may be present on the lip, tongue, vulva, and glans penis. The diphtheria bacillus is, however, apparently unable to flourish on normal skin; but when the cuticle is abraded, as after blistering or in scrofulous conditions when a moist raw surface is present, the bacillus readily flourishes. Granulations also afford a congenial soil. The bacillus may be inoculated during an operation—as, for instance, in excision of the tonsils; we have seen a case in which membrane formed within twenty-four hours of an operation for hypoplasia at the seat of operation, a fatal result occurring in a few days. We have several times seen membrane form on granulations at the external wound in empyema, in one of these cases a fatal result followed. In tracheotomy for diphtheria the wound and skin around the wound are apt to become the seat of a fibrous deposit, the inoculation taking place by the spata coughed through the tube. In newly born infants the granulating surface left after the sloughing of the cord may become the seat of a diphtheritic inflammation.

Complications and Sequelæ.—These, though less numerous than those occurring after scarlet fever, are hardly less important. There is the extension of the inflammatory process from the fauces to the neighbouring parts already referred to—viz. to the larynx, nose, middle ear, and lymphatic glands; the latter may suppurate besides these. The most noteworthy are the following: 1st, albuminuria and uræmia; 2nd, pneumonia; 3rd, disturbed innervation of the heart; 4th, paralysis.

1. **Albuminuria** can hardly be said to be a complication of diphtheria, inasmuch as it is almost constantly present at some time or other of the course in facial, nasal, and laryngeal diphtheria. It is, however, frequently absent in mild cases of wound diphtheria. In some epidemics, according to some observers, albuminuria is much commoner than in others. Our experience certainly has been that albumen is rarely absent from the urine in cases of true diphtheria. The albumen usually makes its appearance from the third to the eighth day. The urine is mostly normal in colour and in amount, but

a few blood corpuscles and epithelial casts may be found on microscopical examination in many cases. In some malignant cases haematuria may be present. The amount of albumen present forms a rough indication of the severity of the case; at least after the disease has existed for a few days. The albuminuria is due to the changes effected in the blood or in the renal epithelium of the kidney by the albumoses or mullinogens present in the blood, and the amount of albumen in the urine represents to some extent the amount of poisoning going on. Suppression of urine and anæmia occur at times, though the symptoms present are not so distinctive as in scarlet fever, as death usually takes place before the symptoms become well marked. Vomiting, perhaps persistent, should always suggest anæmia; the urine may become scanty and loaded with albumen, and perhaps cease to be secreted twenty-four or forty-eight hours before death. Œdema, muscular twitchings, or anæmic convulsions are rare. In cases which recover traces of albumen may remain for months, but chronic kidney disease as a result of diphtheria is rare.

2. In severe cases of diphtheria, **pneumonia** in the catarrhal form is common, and is the result of an extension of the inflammation from the fauces or larynx to the lungs. It is found in nearly all cases of fatal laryngeal diphtheria. It is often hæmorrhagic.

3. In all severe cases at the height of the attack the pulse is feeble and for the most part rapid. It sometimes happens at this time that the heart's action becomes irregular, intermittent, or abnormally slow. This condition is, however, more common during convalescence, or at least when the membrane is disappearing and the patient apparently improving. There is often dyspnoea on the slightest exertion, an intermittent cannoning action of the heart, and frequently vomiting. **Sudden cardiac syncope** is apt to take place. This may occur from any unnoted mental disturbance or from some slight exertion, such as getting out of bed or sitting up to use the chamber vessel. With an irregular action of the heart there is often dyspnoea, frequent vomiting, and slow pulse during convalescence from diphtheria are symptoms of great gravity.

4. A peculiar form of **paralysis** is apt to follow not only diphtheria but also other febrile disorders, as typhoid fever, measles, and erysipelas; it is, however, very much more common after diphtheria. The paralysis comes on in the majority of cases during convalescence, mostly between the third and fifth weeks; it appears to follow mild cases as often as it does severe ones. Its usual course is to attack the soft palate, the first symptoms being a return of fluids through the nose, perhaps only a few drops, and a nasal twang in speaking; on examination of the soft palate shows that its movements are less free than usual. In many cases a slight paresis of the soft palate, which may pass off in the course of a week or two, is the only evidence of post-diphtheritic paralysis. In other cases the paresis is much more decided; when the patient attempts to swallow any food, much of it returns through the anterior nares, and some may perhaps enter the glottis, giving rise to a fit of choking. Other parts may become affected—the pharyngeal muscles and œsophagus, so that deglutition is performed with difficulty and the patient has to be fed through a soft catheter. The pupils may become dilated and unequal from paresis of the circular fibres of the iris, there is impairment

of vision, from the ciliary muscle being affected. The paralysis may extend to any or all of the voluntary muscles, so that the patient is unable to stand or sit up in bed or even raise his head. Further, the respiratory muscles, the intercostals, and diaphragm may be affected, in most instances speedily producing a fatal result. It must be borne in mind that in post-diphtheritic paralysis there is rarely complete paralysis, but rather a partial loss of power, combined with numbness and sensations as of prickings with 'pins and needles.' Both rectum and bladder may also become paralysed. It is important to bear in mind that paralysis may follow very mild cases, so that the patient may be seen for the first time when suffering from the paralysis and make no mention of sore throat. Such cases, especially if there be no paralysis of the soft palate, may be very puzzling, and, if there be weakness of the legs and staggering gait, may be mistaken for tumour of the cerebellum or ataxia. The knee reflex may be absent in such patients, and be many months before it makes its reappearance.

Diagnosis.—The diagnosis of diphtheria in a typical case does not present much difficulty, especially if an epidemic is prevailing. The false membrane on the fauces, and the presence of albumen in the urine, render the diagnosis of diphtheria practically certain. But there may be a fibrinous exudation on the fauces with more or less fever; no urine can perhaps be obtained, or, if obtained, it may contain no albumen, and we may be in doubt about the diagnosis. There may be a membranous exudation on the tongue, lip, nasal mucous membrane, or conjunctiva, with no marked constitutional symptoms, and we may be in doubt as to the nature of the case. In such cases clinical distinctions may entirely fail us, it being uncertain if the case in question is one of mild diphtheria or not. We may be entirely dependent for a diagnosis on the detection of the *D-bacillus* in the membrane or secretions. If we can by microscopical examination or by culture in blood serum demonstrate the presence of Loeffler's *D-bacillus* in the membrane, the diagnosis is certain; if, on the other hand, only streptococci or saprophytic bacteria are present, the case is not one of diphtheria (see Appendix). In cases of 'croup' or *stomatitis* an examination of the secretions, which may be also membranous, may often decide the diagnosis in favour of diphtheria. The disease of the throat most likely to be confounded with diphtheria is croupous or membranous angina; usually, however, in this disease there is no tendency to spread to the nasal mucous membrane or the larynx, and there is less often glandular enlargement. The onset is more sudden; the urine is free from albumen. It is unnecessary, perhaps, to add a word of caution is not excluding diphtheria without very good reason. No albumen may be present in the urine at the time of examination, but be present later; there may be a complete absence of constitutional symptoms, and yet diphtheria be present. A mild case of diphtheria in a household may be followed by a malignant one. Diphtheria is distinguished from scarlet fever by the absence of the rash, though an erythematous blush is present in a few cases. In malignant scarlet fever the rash may be absent, and the glandular swelling and doughy condition of the throat closely resemble diphtheria; there may also be a fibrinous exudation as well as albumen in the urine. Diagnosis is often impossible. The petechial rash, however, is rarely absent in scarlet fever.

Prognosis.—Diphtheria is one of the most fatal diseases with which we have to deal; but the mortality differs widely in different epidemics. The most fatal is undoubtedly the laryngeal; of these probably not more than one case in ten recovers without operation—by coughing up the membrane. In faucial diphtheria the mortality may be as high as 75 per cent.; the younger the child the worse the prognosis. The strong and hitherto healthy share the same fate as the weakly. Of especially bad augury are large quantities of albumen in the urine, much glandular enlargement, excessive nasal discharge, a furied state of the fauces, vomiting, and suppression of urine. A sudden fall of the temperature to subnormal, and an intermitted pulse, are also extremely bad symptoms. Recovery from a severe attack in which there is great depression and much albumen in the urine is exceptional, especially in a child under six years of age. Recovery does, however, take place at times in apparently hopeless cases. Suppression of urine in diphtheria is nearly always fatal; though in one case seen by us, in which the boy had suppression of urine and nasal haemorrhage, recovery finally took place. A fall of temperature in scarlet fever in the absence of septicaemia is a good sign; it is by no means so in diphtheria, especially if vomiting be present and an increasing quantity of albumen.

Treatment.—The indications for treatment are the following: 1st. To isolate the patient in the most airy room obtainable. 2nd. To apply antiseptics to the fauces or affected parts in order to destroy the bacilli and other micro-organisms, and to prevent decomposition and fætor. 3rd. To antagonise the poisons absorbed into the system or formed in the blood. 4th. To support the strength of the patient, and to treat symptoms as they arise.

1st. The patient may be isolated by sending him away to a hospital for infectious diseases, and this is often the best and simplest plan, but it is not always possible. If the patient is to remain at home, the largest room available on the top landing should be selected, or, still better, two rooms adjoining one another, so that the patient can be moved from one to the other, thus allowing the unused one to be ventilated. The supply of a large quantity of fresh air to the patient is of the first importance. *All other children in the house should be sent away, bearing in mind, however, that they may be incubating the disease, so that they should not be sent where there are other children, or to a distance where they cannot be brought back again in case they fall sick.* Arrangements should be made for disinfecting all the excretions and bed linen of the patient.

2nd. There can be no difference of opinion as to the importance of applying antiseptics to the fauces in order to wash away the mucus, decomposing blood, and remains of food, and to destroy as far as possible the micro-organisms. It is needless to say that this antiseptic treatment to be of any service should be begun early in the disease; we can have but little hope of influencing the course of the disease by local treatment in the later stages, but something can be accomplished even then by clearing the mouth of fætid and decomposing matters. To properly carry out the local treatment trained nurses are necessary, as the patient's friends rarely have the necessary skill or the firmness to effectually carry out the details properly; unfortunately, it often happens that even skilled nurses may fall

to accomplish all that we could wish, on account of the fractiousness of the patient. The mucus accumulating in the pharynx and nostrils should be removed by means of a mop of cotton wool attached to a stick, and the antiseptic may then be applied by means of a steam spray, such as Siegel's, or by a hand spray. Failing this, a bull syringe may be used, large enough to hold 3 or 6 oz., the child's head being held forward so that the fluid may run out of its mouth. It may be impossible without a struggle to apply either of these; in such cases we must be satisfied by the insufflation of antiseptic powders, as salutar or iodoform and boric acid, or calomel and boric acid. Ice is useful to suck, and the food may be given iced.

With regard to the success of local treatment in pharyngeal diphtheria, we must remember that many bacilli are present in the mucus secreted, and also in the epithelium, whilst others are embedded in the fibrinous coagulation. We cannot reasonably hope for the destruction of all the bacilli present, especially those in the membrane, by spraying or washing out the throat by antiseptic solutions. To more effectually apply antiseptics, Dr. A. Siebert, of New York, has devised a sort of syringe provided with a number of hollow needles, by means of which some antiseptic fluid can be applied into and underneath the membrane. Among the effectual antiseptics or germicides are solutions of corrosive sublimate (1 to 1,000), carbolic acid (1 to 100), salicylic acid (1 to 1,000), chlorine water, and Condy's Fluid. Solution of peroxide of hydrogen is also useful, and certainly corrects the faecal effluvia. Probably corrosive sublimate is the most effectual of all, but it has the disadvantage of being poisonous, and it has an unpleasant metallic taste. We have known it when used for mopping (1 to 500) produce mercurial stomatitis; there can, however, be little fear of this if used well diluted and with caution. For painting the fauces we use glycerin acid-carbolici one part, with two parts of tr. iodi. Loeffler has recently recommended a 10 per cent. solution of menthol in alcohol, adding 1 per cent. of perchloride of iron.

Calomel fumigation, as described on p. 196, is a convenient way of using mercury.

Dry applications are preferable to lotions in wound diphtheria, as the latter are apt to fret the skin and leave a caustic soil for the bacillus to flourish on. Salicylic acid and starch (1 to 20), calomel and starch, or iodoform and boric acid answer very well. It is a good plan to vaporise carbolic acid in the sick room from time to time.

3rd. The 'serum treatment,' which we owe to the patient intervention of Behring and Rosé, appears likely to take a permanent and important place in the treatment of diphtheria; whether this 'heils Serum' acts by rendering the tissues 'immune' or by antagonising the diphtheria poisons is at present an open question. In any case it is of the greatest importance to commence the treatment as soon as the diagnosis of diphtheria is made with certainty. At the present time no directions can be given with regard to dose, as the dose depends upon the strength of the serum, and this appears to differ widely. No evil effects have been recorded from the serum injections, but erythema, urticaria, and joint pains have been noted by some observers. The local treatment of the throat should be continued during the injections.

We have no great belief in the efficacy of either mercuric bichloride or

petasae chlorat, more internally in diphtheria; the latter is undoubtedly dangerous, as Dr. A. Jacobi long ago pointed out. We prefer to use the old-fashioned tr. ferri perchlor. in three to five minims doses every four hours. It may be given in lemonade, soda water, or in any way in which the patient will take it. Digitalis, calomel, even wine, alcohol, should be given from the first if there is much depression of the system, and in the worst cases alcohol in the form of brandy or port wine must be given with a free hand.

14. The diet supplied to the patient must consist of the most concentrated form of nourishment possible, as in most cases there is great difficulty in getting him to take food on account of the discomfort and pain in swallowing; beef juice, peptonised meat preparations, milk, and nutrient suppositories may be resorted to. If there is swelling or cellulitis, the neck should be painted with glycerine and belladonna and covered with cotton wool. If the glands suppurate, incision and proper drainage must be resorted to. The greatest care must be exercised during convalescence to supply the patient with suitable food and fresh air, and to prevent any exertion on his part. Cases of the soft palate, general paralysis, and failure of the heart may come on at any time within a month or five weeks of the commencement even in mild cases, and the practitioner should constantly be on his guard, and warn the friends against allowing any excitement or unwarmed exertion. During convalescence quinine, strychnine, and iron should be given. The continuous current and massage is of use in the paralysis which follows. Change to the seaside after five or six weeks reckoned from the commencement of the attack will prove of great benefit.

Quarantine.—This should be maintained for three weeks in mild cases, and a month or more in the more severe attacks.

Disinfection.—A temperature of 60° C. in a moist atmosphere is sufficient to destroy the D-bacillus. For disinfection the simplest way is to boil the linen removed from the patient, and treat his clothes, as far as possible, in the same way. The furniture of the room in which he has been should be scrubbed with hot water and carbolic soap, and the floors and walls should be treated in like manner. Wearing apparel which cannot be boiled, had best be destroyed.

Pseudo-diphtheria

Practitioners have long been familiar with a form of sore throat which mostly occurs in epidemics, which in many ways resembles diphtheria, but be the most part runs a milder course, and is not followed by the serious sequelæ which so often follow diphtheria. Such cases have gone by the name of diphtheritic sore throat or "conspicua angina." Recent observations have shown that the D-bacillus is not the only micro-organism which is capable of giving rise to fibrinous exudations, but, at the same time, no other micro-organism is apparently able to produce the depression, albuminuria, and paralysis which so often accompany true diphtheria. Given a variable virulence, several kinds of cocci, especially the *Streptococcus* and *Staphylococcus pyogenes*, are able to produce an inflammatory sore throat with more or less fibrinous exudation; there is also, according to Klein, a "pseudo-diphtheria bacillus" closely resembling the true bacillus in its histological characters, but inep-

able of generating during its growth the toxic albumens produced by the true bacillus. Cases of pseudo-diphtheria may be mild with only slight fever, but, on the other hand, they may commence with vomiting, high fevers, rigors, and the tonsils may be swollen and covered with a membranous exudation. The mortality is not high, being very much less in diphtheria, but fatal cases do occur, sometimes from pneumonia. The clinical course of such cases may be very much like what has already been described under acute tonsillitis. Filiform exudation may occur in other places, as on the nasal mucous membrane, tongue, lip, vulva, corpora, in connection with swarms of other diseases, caused by septic cocci as well as by the D-bacillus.

The one important point in connection with these cases is necessarily the diagnosis. If we can certainly exclude diphtheria, the relief to all concerned will be great. Clinically this may be impossible, and a diagnosis may only be made by demonstrating the absence or presence of the D-bacillus in the exudation or secretions. But difficulties may occur here as long as the question as to the existence of a pseudo-diphtheria bacillus, and its diagnostic characters, is unsettled. In spite of the greatest care, even the most experienced physicians may in some cases remain in doubt as to the presence or absence of the diphtheria bacillus in a given case of an uncertain character. The local treatment of pseudo-diphtheria is much the same as that for diphtheria, antiseptics being employed to destroy the cocci and to keep the fauces and mouth sweet. Carbolic acid, salicylic acid, peroxide of hydrogen, and chlorine water, are among the most valuable. On the skin, starch and salicylic acid powder answers very well. All such cases should be isolated; indeed, every case of tonsillitis occurring in children should be regarded with suspicion and kept away from its fellows during both the febrile and convalescent stages.

Epidemic Influenza. 'La Grippe'

During the last two or three years the British Isles, in common with the continents of Europe and America, have been visited by epidemics of a peculiar zymotic disease, which has received various names, but is best known in this country as 'epidemic influenza.' These epidemics have been widespread, affecting a number of people at the same time, have come to an end in a few months, and then reappeared in the following year. It is very infectious, its incubation is short, and, unlike most zymotic diseases, one attack does not protect from attacks in subsequent epidemics. It is very prone to relapse. In some epidemics in past times children appear to have escaped to a large extent, having been apparently less susceptible than adults. This does not seem to have been so in the recent epidemics, for individuals of all ages have been proportionally attacked, children having been affected in common with adults, though the mortality among the former has not been so high as among the latter, especially in the pneumonic form. In some epidemics children have apparently escaped till late in the epidemic. The incubation is usually a short one, often not more than a few hours, though it may be longer. Certainly cases occur in which a very few hours after the arrival in a household of an infected individual some members of the household are quickly attacked. The disease appears mostly to spread by direct

contagious, and the difficulty of controlling an epidemic arises from the fact that a number of mild cases occur which do not confine the patient to his bed or to the house, so that while going about his business as usual he readily disseminates the disease. R. Pfeiffer¹ has successfully cultivated the influenza bacillus on blood-agar—that is, on agar medium containing haemoglobin. The bacillus occurs in large quantities in the mucus coughed up.

The difficulty in describing the symptoms consists in the absence of any very characteristic ones, and in the multiplicity of symptoms which may be present. Moreover, the type of attack appears to alter from time to time and in different localities. The diagnosis has, in point of fact, often to be made by a process of exclusion, aided greatly by the knowledge that an epidemic of the disease is prevailing at the time, and that perhaps other members of the household have recently suffered. As a result of the difficulty of diagnosis, there cannot be a doubt that many cases in which the diagnosis was doubtful have been described as *adynamia*, inasmuch as the disease was prevailing at the time; and thus it has come so pass that much confusion has arisen, and much that has nothing to do with influenza has been included in the descriptions of this Protean disease. We are far from denying that influenza may not be the cause of diverse forms of inflammatory lesions: we know the so-called pneumonia diplococcus is able to excite not only a pneumonia, but also an otitis and meningitis, and it is by no means impossible that the influenza micro-organism may at one time excite a pneumonia and another time an enteritis or meningitis. The cases in which the greatest difficulty in diagnosis occur are in infants and young children. It is so tempting to attribute an indefinite febrile attack in an infant to teething or dyspepsia, and so difficult to be certain that the attack is due to influenza, unless another case crops up in the same household to give us the clue. In infants we have not the advantage of the patient's account of himself as we have in adults, so that the diagnosis is often only come to with difficulty. One of the commonest forms of the disease in infants and young children is the simple febrile type. Practically the only prominent symptom is fever. The infant is noticed to be hot, there is a temperature of 102° or 103° F., the pulse and respirations are accelerated, it is heavy and drowsy, and then, after a few days or a day or two, the temperature falls, and the infant is practically well again. In many cases the course is protracted, the temperature going up every evening for a week or more before it finally settles down to normal again. In more severe cases the fever suddenly runs up to 104° or 105° (it may be with a convulsion or vomiting), then for days or weeks there may be fever of a remittent or intermittent type, without there being any pneumonia or tubercle or enteric fever to account for the temperature. Finally, a good recovery is made. These cases are often very puzzling, especially the protracted ones, and we may call in question our original diagnosis of influenza, and begin to fear there may be an acute tuberculosis in progress; in all such cases it is, of course, necessary to repeatedly examine the lungs, and to bear in mind the possibility of an acute enteric fever being present; there cannot be a doubt, however, that in young children a fever of the intermittent type, lasting two or three weeks or more, may be due to the influenza bacillus. Convulsions and vomiting are among the frequent

¹ R. Pfeiffer, *Zeitschrift für Hygiene und Infektionskrankheiten*, 12-127.

symptoms in infants and young children, possibly suggesting an acute meningitis; the vomiting is often exceedingly troublesome at times, but the worst cases of this type occur in older children. In others there may be bronchitis and pneumonia of a depressing and fatal character. We have not seen many fatal cases in infants apart from pneumonia, but in one case that we know of death occurred in two days as the result of an attack which was accompanied by high fever and depression. The infant was ten months old, and its mother was suffering from influenza at the time.

In older children the attacks approach more nearly the types of attacks witnessed in adults. But as a general rule the neuralgic pains are less marked, as also are the rigors and backache. The attack is sudden, the temperature coming up to 103° or more, there is severe headache, vomiting, chilliness, and often sore throat. The conjunctivæ are injected and the child has a heavy look. Earache is often a marked symptom. After twenty-four or forty-eight hours of more or less high fever, the temperature falls to normal or it runs a lower course. Some cough remains for a few days, and often marked depression; but this, in our experience, is not so severe as in adults. An examination of the fauces will often show them to be injected, and the tonsils enlarged and covered with yellow points; there may be some glandular enlargement secondary to the tonsillitis. To add to the difficulties of diagnosis, these cases sometimes have a red rash closely resembling scarlet fever. In some cases which we have seen, we had no doubt that they were influenza and not scarlet fever. This conclusion being arrived at either from the fact that influenza was epidemic and there were cases in the same household and neighbourhood, thus from being able to decide from the symptoms and examination of the patient. Krutoytsk records an epidemic of influenza in Warsaw, accompanied by a red rash; on the other hand, Filippow records sixteen cases in which influenza was complicated by scarlet fever. There may be an attack of the simple febrile type, already described as affecting younger children.

One of the most serious forms which the disease can take is that in which vomiting is a prominent symptom. In some of these cases the fever is high, perhaps 104° or 105° F., there may be delirium or an excited state of the nervous system, the conjunctivæ are injected, and the child restless and sleepless. Such a case will often suggest an acute meningitis. The vomiting is often continuous, and gradually exhaustion comes on. In one fatal case of this character which we saw the temperature was not high, not exceeding 102° F., and this for a time made the diagnosis of influenza doubtful. In the worst cases the vomiting continues unrelieved, and the child dies of exhaustion or in a convulsion. At the *post-mortem* no gross lesion is found, but there is usually venous congestion and marked injection of the venous capillaries. Another serious complication is pneumonia; this may be either of the *lobular* or *broncho-pneumonic* type. The course is often protracted, and the mortality is higher than in the ordinary forms of pneumonia. Empyema is not an uncommon result. Less commonly there is a catarrh of the small or large bowel, giving rise to troublesome diarrhoea and colic. We have seen several cases of acute *typhoid* which occurred during an epidemic of influenza, but we could not for certain say they were due to this cause. We

have seen cases that certainly resembled enteric fever. *Herrington's* has been described as occurring in some attacks (G. W. Earle). Severe otitis is an uncommon. Relapses are common, and the possibility of their occurrence will always have to be borne in mind. We have known death to take place in a relapse. As a rule, the depression which so commonly follows an attack of influenza in an adult is much less marked in the case of children.

Supplications.—Chronic otitis is apt to be left by influenza. Various serious sequelae may occur, more especially in adults. We have seen cases in which an irregular and intermittent action of the heart was left by attacks of influenza in children. Recovery seems always to take place.

Treatment.—The patient should be isolated, and confined to bed in a well-ventilated room. As long as the fever lasts his diet should consist of fluids, such as beef tea and warm milk. As a routine method of treatment we generally prescribe a mixture containing salicylate of soda, antipyren, and opium or chloroform. If the fever is high, vigorous antipyretic measures may be required; in this case warm or vapour baths, with doses of phenacetin, antipyren, or antifebrin, may be given. Other symptoms must be treated as they arise. The most difficult cases to treat are those in which the vomiting is a constant symptom. In these cases antipyren in an effervescent mixture, local champagne, and small quantities of raw beef juice may be tried. In the continued fever salicyrin and quinine may be given.

Enteric Fever

As a general rule it may be said that children and young people are more susceptible to enteric fever than are adults, and they usually suffer from it in a milder and less complicated form. It is not common in children under three years of age, though it undoubtedly does occur even in infants, and may be fatal; it is not easy to say at what period of life it is most common, as statistics of fever hospitals are apt to be fallacious, since the milder cases are certain to be treated at home, and children suffering from the disease in a mild form will in a great many cases never enter a hospital at all. According to Collie, ten years to twenty years of age is the commonest time for an attack; five years to ten years of age ranking next. The mortality at all ages from enteric fever, according to Murchison, is 15 to 20 per cent. In children, according to Parthey and Billiet and Gerhardt, 10 per cent. In our own hospital 300 cases have been treated, with 48 deaths, giving a mortality of 16 per cent. It is obvious that too much reliance must not be placed upon these figures, as at the different hospitals a different proportion of severe cases may be admitted, or the mild and abortive cases may or may not be reckoned as attacks.

Enteric fever spreads by direct contact with the sick, by means of emanations from both fresh and stale feces, possibly also by the breath, by inhalations of sewer gas given off from drains into which the excretions of enteric patients have been thrown, and by the taking of drink or food which has become contaminated by the specific bacilli. There is reason to believe that infection may be carried from the sick to the healthy on the fingers or clothes of a third person. The evidence that enteric fever is directly contagious, the disease being contracted by coming in contact with a patient, is

too strong to be captured away—usually the evidence produced by Collie at the Homerton Fever Hospital; and in our own hospital hardly a year passes without one or more probationer nurses contracting the fever from patients they are nursing; and we have known it to happen that patients in the same ward with cases of enteric fever, who have never been out of bed, have contracted the fever, doubtless by the bacillus having been brought to them by one of the attendants. It appears to spread in this way in the crowded homes of the poor, where one member, mostly one of the children, contracts the disease, and remains at home, being nursed in a room where others sleep; then in the course of two or three weeks other members are



Fig. 24.—Temperature Chart of a case of M.M. & W.C. Fever in a boy aged 6 years.

attacked. Indeed no disease is more certain to spread in the crowded dwellings of the poor than enteric fever.

Incubation.—Usually fourteen to twenty-one days.

Symptoms and Course.—In every epidemic cases may be met with which are so mild that they can only be recognised as enteric, as they occur in the same home with other undoubted cases. In such cases the temperature may be fever fast to last intermittent, being perhaps 102° or 103° in the evening, and falling nearly to normal the following morning; evidently these cases were included by the older writers under the term 'intermittent remittent fever.' Other cases, which begin like an ordinary attack, abort by the end of the second week, and are at once convalescent without going through the ordinary three weeks' course. In other cases the morning remission is much more marked, being perhaps three or four degrees lower than the evening,

and this tendency is especially shown after the middle of the second week. In these mild cases the patient does not appear ill; in the morning the child will be seen sitting up in bed playing with his toys; and but for a heavy look about the eyes and a glance at the temperature chart over the bed, it would be difficult to persuade oneself that he was suffering from any febrile disease. Such patients are often brought to the outpatient rooms of dispensaries, and are not considered by their parents as anything but 'out of sorts.' There is rarely diarrhoea in the milder cases. On the other hand, cases of great severity may be met with in children, the fever may run high and last for many weeks, or fatal complications may supervene, or death may take place early in the disease from the intensity of the poison, as in the case of a child of three years coming under our notice who died as early as the eighth day.

Initial Symptoms.—These mostly come on gradually, though exceptionally there is a somewhat sudden onset; the fact that the onset in any case has been abrupt does not certainly negative the diagnosis of typhoid fever. Frontal headache is nearly always complained of with a feeling of dullness which induces the patient to sit over the fire; there is usually 'rattling' at night, less often abdominal pain, diarrhoea, and epistaxis.

Temperature.—In an attack of ordinary severity the evening temperature reaches 104° by the fourth evening, continuing to reach this point or three-fourths once daily for about ten days, the diurnal remissions usually being 1° to 2° ; the remissions then become more marked, amounting to 2° or 3° , the fever gradually subsiding by lysis, and of an intermittent type, returning normal after the twenty-first day (see fig. 45), though perhaps touching normal a day or two before. The highest temperature of the twenty-four hours is usually late in the afternoon at 4 or 5 P.M.; later in the attack it is postponed, and reaches its highest point at 8 P.M. or midnight. In mild attacks there is a marked tendency to remit 2° or 3° or more early in the attack, and in about at the end of the second week, in a way which is rare in adults.

Hyperpyrexia is the exception in children; in a few cases a temperature of 105° or even 106° may be reached, but the usual maximum temperature during twenty-four hours in the first ten days is 104° to $104\frac{1}{2}^{\circ}$.

The temperature curve of a relapse differs very much in different cases; it is usually of a remittent type. It is hardly necessary to insist that the temperature should be always carefully taken during enteric fever, as it affords the best index we possess of the severity of the disease or the patient's progress to recovery.

Tongue and Mouth.—During the first week there is usually nothing characteristic about the tongue; it is coated with a thin white film, but is clean and moist at the edges; there is often a glazed clean strip down the centre. It may remain moist and furred throughout, while later, especially in cases of moderate severity, the tongue is covered with a brown fur, dry, with a brownish glazed central strip. Later the tongue becomes clean, red and glazed; sometimes there are superficial ulcerations on the surface. Sordes very readily collect on the teeth, and the mouth becomes fetid if not cleaned.

Abdomen.—The abdomen does not become distended till the end of the first week; during this time the distension gradually becomes more and

more marked from the accumulation of gas in the small intestines; at the same time a certain amount of pain on deep pressure may be elicited and gurgling detected in the iliac fossa. By the end of the third week, if the temperature has become normal, the abdomen becomes less rounded, and gradually returns to the normal condition. In mild cases the abdomen may be normal from first to last.

Spleen.—The spleen usually enlarges during the first week; the earliest day in which we have felt it to be enlarged was in one case on the sixth day; it continues enlarged and somewhat soft during the pyrexia; according to Jabski, if the spleen remains enlarged after the temperature has fallen, a relapse is to be feared. In some cases there is no enlargement to be felt during life, and the *post-mortem* has revealed a spleen of normal size.



Fig. 45.—Temperature Chart of a case of Enteric Fever in a girl aged 15 years.
● Temperature; ■ Stools.

Stools.—Typical 'pea-soup' stools are the exception in children, certainly diarrhoea is not usually a prominent symptom. The bowels may be constipated or normal, they may be simply loose, or there may be the watery pea-soup stools characteristic of the disease. As a rule it is the severe cases which have troublesome diarrhoea, but cases may be severe with high temperature and prolonged course without diarrhoea being present. During convalescence constipation is apt to be troublesome, on account of the atony of the bowel left by the disease.

Central Symptoms.—Slight delirium at night with a tendency to talk and chatter somnolent is common; acute delirium like that present in typhus or acute pneumonia is rare. After a severe attack the mind sometimes remains weak, a condition of *dementia* existing for some weeks; sometimes

aphasia is lost : more often the loss of speech is due to mental weakness. The prognosis is good, the mind recovering as the system gathers strength.

Eruption.—The characteristic rose spots are present in about 75 per cent. of the cases. The spots may be detected by the end of the first week, rarely earlier ; fresh spots appear daily till towards the middle of the third week ; they may go on longer, into the fourth or even fifth week. They often re-appear during a relapse. Their numbers vary from two or three to many hundred, so that the child has a freckled appearance.

Urine.—If the temperature is high and continuous, albumen is slight quantity is usually present. Iodides is often present. The urine is high-colored and concentrated.

Complications.—The same complications that occur in adults are found also in children. There is the same tendency to **relapses**, there may even be more than one. Not infrequently the relapse is more severe than the primary attack ; death from perforative peritonitis may take place in a relapse. The interepidemic period is very variable. Thus in a severe case the temperature touched normal on the twenty-first day, was then subnormal till the thirtieth, then normal till the thirty-fourth, then a relapse occurred, the temperature varying from 100° to 104° , till it reached normal again on the fifty-third day ; recovery followed. In another case the primary fever ended on the nineteenth day, a relapse occurred on the thirtieth, lasting till the fiftieth. In another the primary fever ended on the twentieth, the relapse occurred on the twenty-eighth, and lasted till the forty-second. In another the primary fever ended on the twenty-fifth, and a relapse occurred lasting from the twenty-seventh to the forty-sixth.

Epistaxis is not uncommon as an early symptom, and is of no importance. Small quantities of blood in the stools are common during the second and third week, and if small in quantity need not be a cause of alarm. **Nasal hæmorrhage from the bowels** is rare, though serious when large in amount, yet we have not seen a fatal case result from it in a child. We have seen severe hæmorrhage in three cases, all, however, ending in recovery. In one case, a girl of eleven years, there was a fall of temperature on the twenty-seventh day, from 102° to 98° , followed by a hæmorrhage of 10 oz. of blood per rectum ; another hæmorrhage occurred on the thirty-first day, and again on the thirty-second day some 12 oz. were passed ; she eventually recovered. In another case, in a boy of twelve years, who was admitted after having been ill a month, the same evening there was a large hæmorrhage per rectum, sufficient to blanch his lips, and for the time he was nearly pulseless ; he finally recovered.

Bronchitis and pneumonia arise on in many of the severe cases ; they occur quite independently of a chill or from taking cold ; they are due rather to stasis of blood in the lungs, mostly at the bases, and possibly also to the local working of the specific bacillus of enteric fever. Diminished resonance with riles and rhoschi are detected at one or both bases if pneumonia is present. The temperature is usually high, and the pulse and respiration are increased. We have seen death take place from this cause on the nineteenth, twentieth, twenty-first, twenty-third, and thirty-fifth days. The pneumonia lung is of a purplish colour, has a solid atious feel, and is when more or less

collapsed on section; the cut surface is not granular like cretaceous pneumonia, but smooth and dark red. The lung is airless, and sinks in water.

Pyæmia, with secondary abscesses in the lungs and elsewhere, the result of septic embolism from the ulcers in the intestines, occasionally occurs. In four of such cases dying in the Children's Hospital, the course of the disease was acute, with hyperpyrexia and an intermittent temperature towards the close; one died on the nineteenth day with suppuration in the parotid, the others on the twenty-fifth, twenty-ninth, and thirty-seventh day respectively. At the post-mortem pyæmic abscesses due to infarcts, and pneumonia were found.

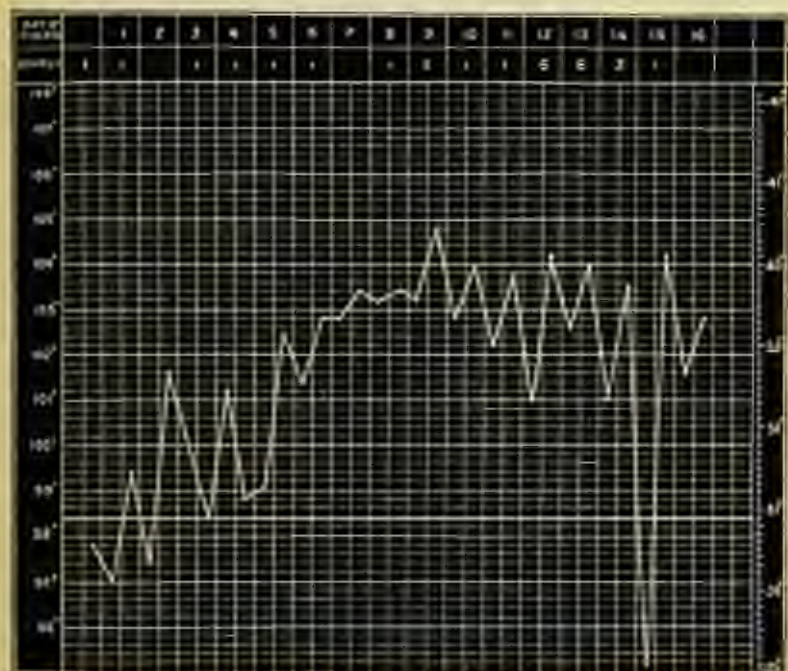


Fig. 26.—Temperature Chart of Enteric Fever. (Continued.) (South American Army.)
 10 = 32° C.

The most dreaded complication in enteric fever is **perforation of the intestine** followed by **peritonitis**, as consequence of an ulcer penetrating through the wall of the intestine. This complication is fatal with very few exceptions, though it is difficult to say if it always is, as cases with symptoms of peritonitis sometimes recover, and it is not unreasonable to suppose that at times an extravasation may take place, the affected portion having become glued by means of lymph to another piece of intestine. In four of our cases death occurred on the sixteenth, twenty-second, thirtieth, and forty-eighth days respectively. In the case in which death occurred on

the sixteenth day, it was not certain if it was the sixteenth day of the primary fever or of a relapse, as there was a history of indefinite illness before admission. The temperature on admission was normal, though there was some rhectus and riles were found in the chest; the disease ran an acute course (fig. 46) for fifteen days, when suddenly there was collapse, the temperature falling abruptly, with vomiting and abdominal pain; the temperature rose again to 104°, death occurring next day. A perforation in the ileum, three inches from the caecum, was found, with extravasated faeces and general peritonitis. In all the cases there was abdominal pain and collapse a day or two before death. In the case in which death occurred on the forty-eighth day, the girl had been ill three weeks before admission, and the attack treated in the hospital may have been a relapse. There was hyperpyrexia and intermittent fever.

Some cases of enteric begin with tonsillitis and **membranous exudation** on the tonsils; occasionally sloughing tonsillitis supervenes in the course of the attack; this was so in one fatal case, in another a membranous laryngitis occurred causing death on the twenty-first day. **Otitis** may occur, and occasionally a fatal result follows from thrombosis of the lateral sinus and pyæmia.

Tuberculousis may complicate the course of enteric fever, or it may follow as a sequelæ. In one case a child died of pneumonia on the twenty-first day; tubercles were present on the pleura and in the lung. In another case a girl recovered from enteric, the temperature becoming normal on the twenty-ninth day; it remained normal for a few days; she continued to improve for a month, though the temperature went up occasionally at night. Then hectic fever came on, with vomiting, and she died sometime three weeks after; the *post-mortem* showed tubercular meningitis and a few tubercles in the lungs.

Diagnosis.—During the first few days the diagnosis of enteric is difficult, often impossible, and especially in children typhoid may be confounded with the feverishness which so often accompanies dyspepsia and intestinal catarrh. Children are frequently brought to the out-patients' room of children's hospitals with indefinite symptoms and feverishness; a tentative diagnosis of enteric is made, but in a few days the symptoms disappear and the child is practically well again. Such attacks may be more severe, and it may be impossible to say whether the patient has had an abortive enteric attack or not, unless there are unobscured enteric cases in the household. In all doubtful cases, in the early stages, the temperature should be carefully taken every four hours and a careful examination made for rose spots and enlargement of the spleen. The diagnosis in small children and infants is extremely difficult, on account of the many causes, such as patchy catarrhal pneumonia, intestinal catarrh, infestation, and tuberculousis, which may give rise to an intermittent or remittent fever; it must have occurred to almost every medical man in practice to have seen babies or young children with an intermittent fever lasting two or three weeks or more, with distended abdomens, but no distinct enlargement of the spleen, rose spots, or diarrhoea. Perhaps there are no cases of enteric in the neighbourhood. Here diagnosis may be impossible. We have never seen a fatal case of typhoid in an infant under two years of age, but such cases have been recorded. It is possible that some of

those continued febrile attacks are due to some other form of bacillus. The bacillus coli communis has been suggested by some French authors; they believe it may take on a malignant action.

Acute Miliary Tuberculosis and enteric may be very similar, and for a week or two the diagnosis may have to be held in abeyance. Careful temperature taking every four hours will often greatly aid the diagnosis. In acute tuberculosis the fever is mostly intermittent, the diurnal ranges being perhaps 3° to 5° ; there are no true spots, nearly diarrhoea; miliary tubercles may occasionally be detected in the throat, crepitation may be heard in the lungs, or there may be some want of resonance at one apex; the abdomen is not usually rounded. **Tubercular Meningitis** in the early stages may simulate enteric. A child who is seen for the first time, recovering from typhoid fever, being anæmic, wasted, and having perhaps some cough with rattle heard on examining the chest and possibly bedsores, might readily be thought to be suffering from **Chronic Tuberculosis**. If there is diarrhoea and abdominal tenderness, the two diseases at this stage may be still more alike. A careful examination of the lungs would generally distinguish between the two, as in chronic tuberculosis some consolidation at the apices or elsewhere would usually be found. **Pyæmia** may resemble enteric fever, especially in those cases where the pyæmia is secondary to some bone disease without any external wound. A case of pyæmia secondary to Pott's disease of the spine, with abscesses in the lungs, which came under our care was thought for a few days to be enteric fever; but the daily ranges of temperature are more extreme, the type more markedly intermittent in pyæmia than typhoid. A rounded distended abdomen, with a purple rash, may certainly occur in other diseases than enteric, though when true rose spots are present they are characteristic.

Morbid Anatomy.—The solitary glands and Peyer's patches are swollen in catarrh of the bowel, enteritis, also in scarlet fever and lepticæmia, as well as in enteric fever. Ulceration occurs in the later stages of enteritis, dysentery, and tuberculosis, as well as in typhoid. In a typical case of typhoid there is usually no difficulty in making a *post-mortem* diagnosis, as the swollen condition and ulceration of Peyer's patches, enlargement of the spleen and absence of tubercle are sufficiently characteristic. If death takes place early in the disease, there may be more difficulty. Eberth's typhoid bacillus is with difficulty distinguished from other bacilli in the feces, but if present in spleen pulp or urine, then its diagnostic value is much greater.

Treatment.—The management rather than the medicinal treatment of typhoid fever is of the greatest importance. The patient must of course be put to bed in a cool room, and arrangements made for both night and day nursing; it is needless to emphasise the importance of a trustworthy nurse at night to feed and attend to the patient's wants and soothe him to sleep. Sponging with warm water to which some Condy's Fluid or Salvarsan has been added, should be performed every evening before settling the patient for the night, great care being taken to cleanse the buttocks and anal region, especially if the patient is suffering from diarrhoea, as the stools are apt to be smeared about. To keep the patient's back scrupulously clean is a matter of importance in the prevention of bedsores. The patient's mouth must be

carefully attended to, and cleaned by means of a pine brush or rag of decomposing food and fecal secretions; the more ill and anæmic the patient is, the more important does this become. Girdy's Fluid or dilute solution of benzoglycose may be used for the purpose. The diet should consist of milk diluted with barley water or soda water, and in amount should be varied to the age. During the pyrexial period milk is better taken than beef tea or other savory foods, which as a matter of fact are quite unnecessary. The more thirsty the patient is, the more must his milk be diluted, lest too much acid remain undigested in the stomach and intestines and give rise to flatulence and discomfort; a pint and a half to a quart of milk daily will be sufficient. An excess may give rise to diarrhoea or accumulate in the large intestine as hardened feces. In the later stages, when the tongue is clearing, beef tea is usually taken well and forms a pleasant change of diet. Where milk does not agree, or when the diarrhoea is troublesome, peptonized milk or Benger's Food should be given. It is well to continue the fluid diet till a full week after the temperature has become normal. One usual position is to allow sops in the milk or beef tea on the thirtieth day, at once discontinuing it if the temperature rises. In mild or median cases alcohol is unnecessary. No medicine is required; a simple saline may be given. The treatment of hyperpyrexia must depend upon the effect which it has upon the patient, though in any case, if the temperature rises to 104°, sponging the head, trunk, and limbs with water at 60° should be resorted to, or the cold pack may be given, provided there is no immediate risk of peritonitis. If the temperature is not kept in check by these means, but the fever is now making the patient delirious or delirious, no other means need be taken, except perhaps applying an ice bag to the head. Other means are however available, such as the administration of antifebrin or quinine, and the graduated bath. Antifebrin may be given in a large dose or in small doses of two or three grains, frequently repeated, so as to keep the hyperpyrexia in check, rather than to reduce it suddenly, as the latter result is attended by more or less collapse; in any case both antipyrin and antifebrin are apt to be depressing, and can only be safely used in the early stages, and not for too long a time together. In the early stages, with due care, the graduated bath is useful in reducing temperature; in the later stages it is contra-indicated, on account of the disturbance to the patient which it entails. The patient may be placed in the bath at a temperature of 80°, and cold water added so as to reduce it to 70° or 60°, though it is rarely wise to allow the child to remain in longer than five minutes. Excessive diarrhoea should be checked by starch and opium mixture, or Dover's powder by the mouth; sleeplessness and delirium by a wet pack or small doses of veratrine, the latter being more useful than bromides, chloral, or urethan; abdominal pain or tenderness is best treated by veratrine in free doses by the mouth, and again foreremission, while the food and liquids taken are reduced to a minimum compatible with safety, guarded by stimulating applications such as mustard pastilles or turpentine strips, the latter being used with great care on account of the sores apt to be produced. Any signs of cardiac depression must be combated by alcohol in the form of mist, vin gallie, or champagne, or by caffeine, ammonia, ether, or digitalis.

It is often an anxious question to decide as to whether a laxative should

be given when the bowels are constipated, inasmuch as a patient is rendered more comfortable by a free action of the bowels, and the discomfort and discomfort are lessened. On the other hand, one fears that the peristalsis set up by a purgative or even an enema may do irretrievable damage by converting an ulcer into a perforation or tearing down adhesions of lymph which have formed. At the same time it must be remembered that hard lumps of feces irritate the bowel and fret and rub the ulcers, and in some of the worst instances of excessive ulcers in fatal cases we have found numerous hard lumps of feces in the lower part of the ileum and large bowel. Small doses of castor oil during the first ten days are often beneficial if the bowels are confined; after this time enemata are safer, though they are not free from risk, and should certainly be avoided if there are signs of peritonitis. If severe hæmorrhage from the bowel occurs, the greatest care must be taken to give the child only the smallest quantities of food by the mouth and to keep him as quiet as possible. An ice bag should be placed on the abdomen and a grain of ergotin given subcutaneously and repeated every two or three hours. Opium should be given in small doses if there is much restlessness. Turpentine or creosote in two or three drop doses in mucilage is useful as a stimulant and hæmorrhagic.

Can we abort enteric fever by giving laxatives or antiseptics? This is a disputed point, inasmuch as enzyme frequently aborts, especially in children, without the help of drugs, and the diagnosis in the early stage is difficult. We certainly believe that the danger of setting up perforation peritonitis by giving purgatives has rather frightened us unconsciously into the too sparing use of evacuant remedies such as calomel or castor oil. Small and repeated doses of calomel or castor oil during the first ten days may be safely given, and in many cases with great benefit. We are less inclined to the drastic doses of calomel advocated by some physicians.

During convalescence dyspepsia and constipation are frequently troublesome; flatulence and a rise of temperature are very apt to follow any excess of starchy or any indigestible food, especially in early convalescence. The food should consist of meat essences, of broths, jellies, powdered meat, chicken, and fish, with small quantities of toast or stale bread. Good theory with a grain or two of pepper and some liquid malt extract, such as that of Allen and Hanbury's or Hoff's, are often very useful. The constipation is usually slow in disappearing; purgatives should be avoided, as the constipation is simply due to wasting of the muscular fibre of the bowel and reduced secretions. In this condition the mineral acids, slychismine, cascara sagrada, and bitter are of most use.

Typhus

During an epidemic of typhus children suffer equally with adults, though the mortality is exceedingly small. It is probable that the fact that children usually suffer from the disease in a mild form and but few die, has given rise to the general belief that children are less susceptible to the typhus poison than are adults. That this is not the case has been shown conclusively by Dr. Buchanan, who, after referring to the slightness of the fever in children, says: "When inquiry as to age is made to include every case of

attack, children and adults are found to be equally susceptible; the actual incidence may even be observed to be strongly upon the young, partly because of their greater numbers and partly because adults are frequently protected by previous attacks. That many children are attacked with typhus is shown by the statistics of Huxton Fever Hospital (given by Collier), for out of 711 admissions of typhus to the hospital during the period 1871-1886, 74 were under 5 years of age, 54 from 5 to 9 years, 115 were from 10 to 14 years of age; it is more than probable that the proportion really attacked as compared with adults was much greater, but on account of

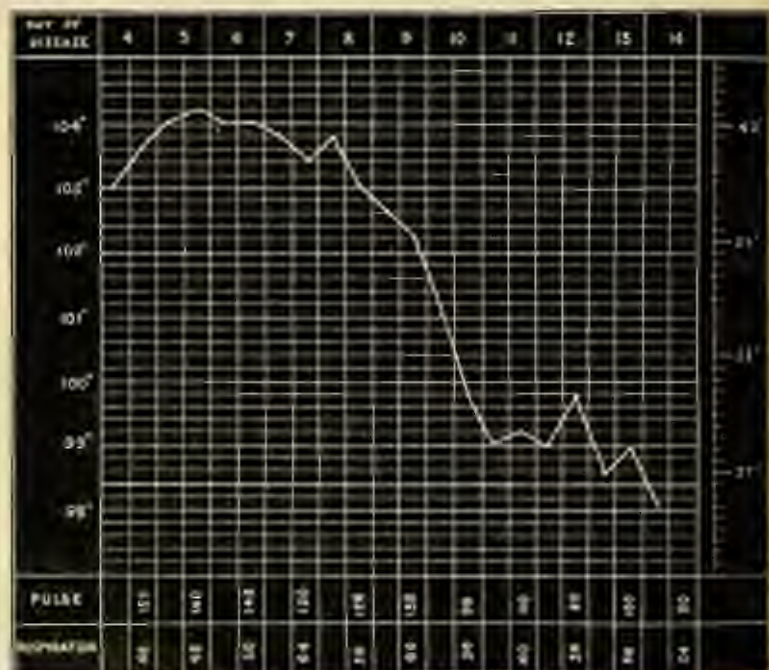


Fig. 17.—Temperature Chart of Typhus Fever, rising in severity. Edw. G., aged 7 years.

the mildness of the fever they were nursed at home and not sent to hospital. Only two deaths took place among the 191 children under 14 years of age all visited, while the total mortality was ten times greater, being nearly 25 per cent.

Symptoms and Course.—The symptoms and course do not differ from those seen in adults, with the exception of their usually greater mildness. The attack commences with headache, pains in the limbs, drowsiness, more or less diarrhoea, sometimes vomiting, rarely flatulencia. This history closely resembles that often obtained in scarlet fever, and this should be borne in mind, as a hasty conclusion as to the nature of an attack may be a wrong one. If seen for the first time in the end of three or four days, there is a

listless expression on the face; it is flushed, the eyes suffused, the conjunctivae injected; the child may answer questions if spoken to sharply, but is drowsy, semi-delirious and irritable if interfered with. The tongue is dry, coated with a brown fur and protruded with difficulty, the lips are black, there are scordes on the teeth, while the gums easily bleed. An examination of the lungs reveals the presence of rhonchi, perhaps rales, and some loss of resonance at one or both bases. On the fourth or fifth day the rash usually appears; the skin has a dusky congested appearance, with an indistinct mottling, in addition perhaps to petechial points, due to flea bites; for our patients with typhus usually come from the dirtiest and most squalid quarters. Perhaps a dusky mottling is all that can be seen, but in more typical cases the rash is more definite, consisting of rose-coloured spots or macules larger than typhoid spots, and with more ill-defined margins, scattered over the body. According to Collie they are first seen on the sub-clavicular regions, along the lower border of the pectoralis major, on the wrists, back of the hands and epigastrium. We have sometimes noted the rash especially well marked on the dependent parts of the body, sides of the thighs, and arms, and back, extending along the neck on to the cheeks, and present also on the dorsum of the feet. The temperature is usually continuously high, 103° to 104°, the pulse small and weak, perhaps 120 to 130, and there is some cough, and frequently much delirium or wandering at night. The fever may last for the whole two weeks; more frequently the symptoms undergo marked amelioration after the first week, and possibly the temperature declines to normal by the eighth or tenth day, all the symptoms becoming milder and the rash disappearing without becoming petechial, as it often does in adults. The rash may be only visible for a few days or may fade as the fever becomes less. While the above description applies to a typical case in a child, very severe ones may sometimes be met with, though far oftener the symptoms are decidedly milder. The tongue may never be brown, only coated with a white fur; the rash may consist of a dusky mottling only; there may be drowsiness without active delirium. The late Dr. Tomkins observed in some of his cases at Monall Fever Hospital that there was marked torpor and lethargy during the first few days, so that the child was with difficulty aroused to take food.

It is obviously important to recognise typhus, though the attack may be mild, as such cases are of course infectious and may spread the disease. Dr. Tomkins recorded the case of a woman who contracted a fatal attack by sleeping with a child suffering from mild typhus, the cause of the child's illness not having been recognised.

Diagnosis.—The fact that typhus occurs in epidemics and is apt to prevail in the overcrowded and poverty-stricken quarters of a large city often helps the diagnosis; but occasionally an epidemic breaks out in a school or in the homes of the well-to-do. The onset of the attack may suggest scarlet fever; the high fever, drowsiness, and dusky condition of skin present in a malignant case of the latter disease might render the diagnosis doubtful at first; but the condition of the tonsils would usually clear up a doubt if the characteristic rash of scarlet fever was not present. Nevertheless we have seen a case fatal in two or three days that gave rise to some doubt, and in the absence of a path-warrant was never cleared up. The disease most likely

to be mistaken for typhus is **acute pneumonia** (Coffa); this is in accord with our own experience, as we have seen cases of acute cerebral pneumonia, with physical signs delayed, sent into hospital as typhus; the mistake is likely to occur, as in most cases of typhus some riles or rheclis are to be found.

In 'cerebral pneumonia' the lesion is often in the apex of the lung; if seen on or after the fourth day of illness, and there is bronchial breathing or dullness, or more high-pitched rales over a portion of lung and so forth, the disease is almost certainly acute pneumonia. A dusky or mottled skin, brown dry tongue, riles or rheclis scattered over the whole lungs or bases, would indicate typhus. **Enteric fever** may be mistaken for typhus, especially when acute, but the insidious nature of the onset, the absence of mottled delirium or looper, the tenderness on pressure over the alakes, and the rose spots usually suffice to make a diagnosis. We have seen some cases of typhus where there was a good deal of general hyperaesthesia and muscular tenderness, where pressure on the abdomen evoked expressions of pain.

Prognosis.—This is usually good, but fatal cases sometimes occur, the children succumbing in the first few days of the fever from the intensity of the poison.

Treatment.—That of fever generally. Sponging with Cool's Fluid should be resorted to daily; the apartment should be large, airy, and warm; stimulants are required in all but the mild cases; milk and other liquid nourishment must be given in suitable quantities. Directly convalescence has set in a more liberal diet may be allowed.

Varicella

Varicella is a specific infectious disease closely resembling modified smallpox, though perfectly distinct from it. There are still a few who believe varicella to be a variety of smallpox, notwithstanding the many facts which point in a contrary direction; these may be summed up as follows: the two diseases are not mutually protective—children who have recently had smallpox may contract varicella; during epidemics of one disease the other is not unusually prevalent; smallpox affects all ages, varicella affects children almost entirely; inoculation with the virus of smallpox produces smallpox, inoculation with the contents of the vesicles of varicella when successful, produces only chicken-pox.

Varicella occurs in epidemics in schools, workhouses, children's hospitals, and among the poorer classes of society where there are many children in constant contact with one another; in epidemics, however, not so widespread as those of measles or whooping cough, nor does it affect so large a proportion of the population. It affects children almost entirely; this in 544 cases observed by Blasdel in 1886, 98 per cent. were under the age of ten years, and 65 per cent. below five years of age. Adults do, however, occasionally take it. We have several times seen nurses contract the disease from children suffering from it.

Varicella can be communicated from the sick to the healthy by inoculation, by simple contact, or by infection being carried by a third person.

Trenseau failed in his attempt to inoculate: Stiehr seems to have been more successful, succeeding in eight cases out of ten. The disease is most usually communicated directly from children suffering from or convalescent from an attack; it is also certain that the infection can be carried by means of a third person, and remain in an active condition in clothes for many weeks, inasmuch as sporadic cases of the disease will occur in hospital wards of patients who have been in for measles, and where no cases had occurred previously in the ward for a long interval.

Symptoms.—The incubation period in the inoculated cases reported by Stiehr was eight days; when contracted in the ordinary way it is usually about fourteen days, sometimes a day or two more. We have on several occasions had an opportunity of verifying this. There are usually no *premonitory symptoms*; the discovery of papules and vesicles on the body is

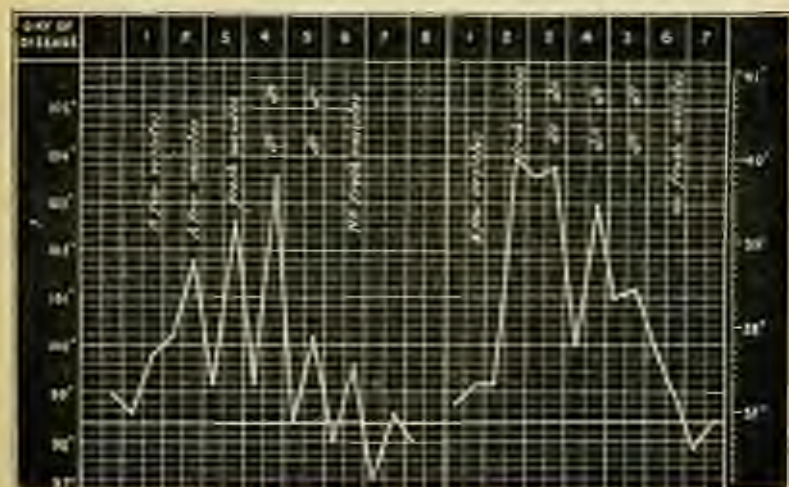


Fig. 25.—Temperature Chart of two cases of Chicken-pox in children, a 3-year-old and 18 months.

usually the first thing noted by the friends. In a few cases there is a diffuse redness of the body resembling the roseolous rash which sometimes precedes measles, and which has given rise to the suspicion that the case is one of scarlet fever; in one case a morbilli rash, preceding the vesicular eruption, made it look as if the child was suffering from both measles and varicella, but of this there was no corroborative evidence. Frequent micturition was observed in one of our cases before the rash appeared. The premonitory fever if present is of short duration, varying from a few hours to twenty-four hours, and in this respect varicella presents a marked contrast to variola. The temperature is not as a rule characteristic, and varies with the severity of the attack, mild cases with only a few vesicles being feverless, severe cases with a great number of vesicles being accompanied by a temperature of 104° or more. The most frequent type is the intermittent (fig. 25).

The rise of temperature is accompanied by an accelerated pulse, coated tongue, and restlessness, though in mild cases these may be absent; in a few hours rose spots, resembling the rash of typhoid, appear and quickly become vesicular. Promptly at the time the first examination is made there will be both rose papules and minute blebs or vesicles containing clear fluid and surrounded by a zone of redness. By the next day a fresh crop of papules and vesicles will have appeared, the vesicles of the previous day are larger, perhaps some of them have aborted and commenced to dry up. Fresh crops appear on the third, fourth, fifth days, and perhaps later still, so that when the attack is at its height, as it usually is on the third or fourth day, the trunk and extremities are thickly covered with vesicles and scabs,



Fig. 45.—*Varicella gangrenosa*. Child and 2 years. From a photograph taken some days after the patient died of tuberculous death. The patient died of tuberculous death; she had had an attack of *Varicella* two months before death.

probably also a few pustules where there has been some scratching and the vesicles have burst. The contents of the vesicles are at first quite clear; as they enlarge their contents become more cloudy, but yet purulent unless the vesicle has been injured and part of its contents has escaped. The vesicles are mostly unilocular, their upper surface is convex and collapses as soon as it is picked, though in some cases a few vesicles may be seen more or less flattened, umbilicated, and multilocular, closely resembling mollusca or vaccination vesicles. The number of vesicles varies greatly; in some cases only a few are present, in others there may be many hundreds. They are never confluent. In the majority of cases the vesicles dry up and scabs are formed at their site; these fall off in the course of a few days, leaving clear and healthy skin beneath. In some of the worst cases this is not so; an ulcer, which may be some weeks in healing, forms beneath the scab and thus a scar is left not unlike those following severe smallpox.

The vesicles make their appearance on the trunk, limbs, and scalp; they are generally more sparsely present on the face, tongue, and soft palate.

The prognosis in *varicella* is uniformly good, as it is apparently never fatal in a previously healthy child. In weakly and tubercular children the *varicella* vesicles are apt to be followed by spreading ulcers, which, joining one another and taking on an unhealthy action, sometimes assist in bringing about a fatal result. Such cases have been described by Mr. Hutchinson under the name of *varicella gangrenosa*; they are not uncommon in the congenital form (see fig. 45). The gangrenous action is usually associated with tuberculous, and it is curious that in all fatal cases of this affection—as has been remarked by Dr. J. P. Payne—tubercle has been found *post mortem*.

Eastace Smith has known acute tuberculosis to follow varicella, and we have also seen several such cases. Nephritis is an occasional sequelæ, as first noted by Herxich.

Diagnosis.—The disease with which chicken-pox is most likely to be confounded is mild or modified smallpox, but as a rule no difficulty is experienced. The points of most importance in making a diagnosis are the absence of prodromatory symptoms and the character of the rash; the following table shows these:

VARICELLA.

Incubation.—Thirteen to sixteen days.

Prodromatory Fever.—A few hours.

Prodromatory Symptoms.—None or slight.

Rash.—Rash spots becoming vesicular in a few hours and drying up in three or four days, leaving crusts; coming out in crops in less or in five successive days on the scalp, trunk, limbs, face, and mucous membranes. The vesicles are mostly umbilical.

Temperature.—Intermittent in character.

VARIOLOID, or modified Smallpox.

Twelve days.

Two or three days.

May include headache, backache, drowsiness, vomiting, delirium, convulsions.

Rash similar papules appearing on face, trunk, body, limbs, and soft palate; on the course of a day or two the papules becoming vesicles, and developing umbilical by the eighth day, or they may dry up leaving only scabs.

Sudden rise, reaches its height when the papules are fully out; then comes a speedy fall. The secondary fever is slight or absent in modified cases.

Occasionally a vesicular syphilitic eruption may simulate varicella, though such eruptions are rare in congenital syphilis, and when present take the form of bullæ of various size rather than vesicles. In one case which came under our notice, a vesicular syphilide closely resembled varicella, but there was no fever, and some brown staining followed the rash.

Quarantine.—How long does the infection last in varicella? No case should be considered past the infectious stage until all the scabs have cleared away and the skin is quite smooth and normal. This is usually accomplished in three or four weeks. In one case which was admitted to hospital, suffering from pyæmia, which had succeeded the eruption of chicken-pox, and where some ulcerated ulcers were present, the admission into the ward was followed by an outbreak of the disease some fortnight afterwards. The child admitted had had chicken-pox five weeks before.

Treatment.—Not much treatment is necessary. The child should be isolated, and preferably be kept in bed if there is a copious eruption. A light diet should be given, and ointment containing some tarry or carbolic compound will be useful to apply to the scabbing vesicles.

Vaccina.—*Performance of Vaccination*.—The safest age for vaccinating infants has been in dispute, some preferring to vaccinate within a few weeks of birth and before the monthly nurse leaves, while others much prefer postponing the operation till three or even six months. Inasmuch as unvaccinated children under one year if they contract smallpox almost certainly die, no time should be lost in vaccinating infants if there is any chance of their being exposed to contagion—as, for instance, if smallpox exists in the home or is present in the neighbourhood in epidemic form. On the other hand, if the risk of their being exposed to contagion is small, it is unwise to vaccinate.

during the first few weeks of life, on account of the disturbance of the general health liable to follow; infants of three months or six months old bear the operation better than infants a few days or weeks old. It is of importance to postpone vaccination beyond the end of the third month if the infant is not robust, or suffers from diarrhoea, malnutrition, eczema, meningitis, or if erysipelas is prevailing in the neighbourhood. Revaccination should be performed at or before puberty. If human lymph cannot be obtained from an infant of an undeniably healthy family, fresh calf-lymph should be obtained, and if the latter is used, any objection to the performance of vaccination on the ground of transmitting syphilis and other diseases is obviated. Calf lymph answers usually very well; it is more viscid than human lymph, and consequently may fail to take unless care is taken to work it well in. The circle should be removed by a few scratches of a needle or lancet at the spot where a drop of lymph has been applied. After vaccination nothing is usually to be seen till about the third day, when there is some itching and a slight redness surrounding the spot, or there may be a tiny papule. By the seventh or eighth day there is a flattened vesicle at the seat of puncture, containing clear fluid in various loaths. During the next few days a red areola forms round the vesicle and its contents become cloudy; by the tenth or eleventh day the fluid comes out and forms a scab on the surface, which, becoming detached, leaves a superficial ulcer, which takes a variable time to heal; a permanent cicatrix, which is circular, depressed, pale, and pitted, is left. The size and distinctness of the scar will depend upon the ulceration which has followed the puncture; if the latter dries up without an ulcer forming, there will be hardly any scar left. There is often some febrile disturbance from the fifth to the tenth day.

What are we to regard as the best vesicles for obtaining lymph from? According to Dr. Hugh Thompson,¹ they are such as, at the beginning of the eighth day (the day usually chosen for taking lymph, although not always the best), show the pockiness made in vaccinating well healed with no scabbing, the vesicles deposited in the centre and elevated at the margin, containing a moderate amount of lymph, not unvarnished; that is, flat in proportion to breadth, and not having lost the inequalities, horns and foam—resulting from some of the connections between the epidermis and corium still remaining intact, the vesicle incipient or only slightly developed. The lymph which exudes from them, on being pricked, is nearly if not quite limpid, somewhat viscid, moderate in quantity, and does not tend to run down the arm.

As a general rule it is the fittest children—those, at least, who are such in the eyes of the vaccinator: "children of dark complexion, with a thick, clear, smooth skin," as Stenton remarks, indications of a strong vigorous constitution—who furnish the fittest vesicles. At the same time care must be taken to see that the child is in perfect health, and especially, by a thorough examination, that it is free of all skin diseases, and more particularly all indications of syphilis, among the most persistent and obvious of which (excepting, of course, manifest syphilides) are chronic *crocea*, generally brownish; a depressed nose, open fontanelles, hydrocephalic head, turgid veins

¹ "Inoculation for Smallpox," by Hugh Thompson, M.D.; *Oxford Medical Journal*, vol. xviii.

of scalp, rudid lymphatic glands. Many of the manifestations of syphilis disappear under treatment, and it is possible they may have thus disappeared without the disease being thoroughly eradicated; but it is rare that one or more of the above may not be found if searched for. It is superfluous to caution against the smallest admixture of blood.

Complications and Sequelæ.—These are fortunately few, though numerous and important in the eyes of prejudiced persons, and a lengthy list could be easily compiled if all the evidence collected by such were to hold good. The most important are the following: (1) **Syphilis** (see *above*): (2) **Erythema and Erysipelas.** There may be an unusual amount of redness and hardness surrounding the pustule, as a result of the lymph raising more irritation than it conventionally does; this may spread down the arm, and give rise to some glandular enlargement without there being any erysipelas present. Erysipelas does occasionally occur. The erysipelas occurs may gain entrance into the wound at the time of vaccination; in this case symptoms will probably arise within a few days, the incubation period being a few hours to two or three days. It is impossible to say for certain that it may not be longer. In a case which came under our notice the seat of the vaccine punctures began to become inflamed nineteen or twenty hours after vaccination. In such cases the vesicles and pustules often mature earlier than in normal cases, and a vesicle may be present on the second day, with more or less redness around the punctures. The patches of redness and oedema are migratory, as in other forms of erysipelas—that is, they do not necessarily remain in the immediate neighbourhood of the wound, but may affect the face, trunk, or any other part. The mortality of vaccine erysipelas is very high, most of the cases being fatal, death occurring in one to three weeks. It has unfortunately happened that the vaccine has been taken from an infant suffering from or incubating erysipelas, and has communicated erysipelas to infants vaccinated with it. Erysipelas may supervene at any period between vaccination and the healing of the pustules if the infant is exposed to the infection, the coel becoming accidentally implanted into the wound. (3) **Glandular enlargement.** The axillary and cervical glands may enlarge and suppurate during the maturation of the pustules, or more commonly in the second week. We have seen several cases in infants with chronically enlarged and discharging superficial cervical glands of the left side, which had commenced to enlarge shortly after vaccination, and it appears likely that in infants of a tubercular or 'strumous' tendency vaccination may be the exciting cause. Similar chronic axillary adenitis is also occasionally seen produced by vaccination, just as by any other irritation. (4) **Cold abscesses** and both may form in various parts of the body, as they will at times after all suppurations, especially in tubercular or 'strumous' children. (5) Various rashes occasionally make their appearance, mostly towards the end of the week, when the vesicle is maturing. A **roseolous** rash over the body and arms, which is fugitive, disappearing mostly in twenty-four hours; a **vesicular** rash, consisting of a few purples becoming vesicular; a **lichenous** rash; and patches of **eczema** may be sometimes present. We know of no evidence which directly connects eczema with vaccination; it is very common during infancy in one form or another, and it is not surprising that vaccination often gets the credit of producing it. An **impetigo** is not

uncommon, having been produced by inoculation of the secretions from the pustules by means of the finger nails.

Varioloid or Post-vaccinal Smallpox.—Unvaccinated children suffer from smallpox in as violent a form as do unprotected adults; indeed, according to Collie, "smallpox is very fatal in unvaccinated children under five years of age, more than half dying, and nearly all infants under one year."

Children who have been vaccinated in infancy and take smallpox usually suffer from it in a modified form; there may be no rash at all, or more often the attack aborts and the vesicles dry up without passing through the pustular stage, the secondary fever being absent or only slight. Sometimes



Fig. 56.—Temperature of case of modified smallpox in a girl aged 15 years. Primary rash on the third day, becoming pustular on the fifth.

the attacks, according to Collie, are so slight that diagnosis is impossible, except from the fact that they occur after exposure to infection or in association with cases of undoubted smallpox. The premonitory symptoms may be present—headache, feverishness, backache—which disappear before the rash appears, the attack coming to us and without any popular eruption. It is much more common for the attack to abort immediately after the rash appears, secondary fever or pustulation being absent. The premonitory symptoms may be severe—headache, backache, the temperature rising to 103° or 104° on the third or fourth day, a copious eruption of papules appearing, perhaps being confluent on the face, to be followed by a sharp fall in the temperature of perhaps 4° or 5°. The papules become vesicular and dry up with but slight if any pustulation, and the child is convalescent at once.

The temperature chart (fig. 50) was that of a child aged ten years who was convalescent from scarlet fever, and who contracted smallpox while in the scarlet fever ward; the only source of infection which could be traced was a visit of her mother twelve days before, the latter coming four miles from a district where smallpox was prevailing. There was marked headache but no pain in the back; on the third day an erythematous rash was seen on the body, which suggested that her illness might be scarlet fever, though she had passed through a typical attack some weeks before; on the afternoon of the same day a few tiny papules like the rose spots of typhoid were seen on the abdomen and arms, the headache was severe and the eyes suffused. The spleen was enlarged, being felt 1½ inch below the ribs. On the fourth day the face, neck, trunk, and limbs were covered with well-defined papules, many confluent. The same evening the temperature fell from 104° to 97°. On the fifth day the eruption was copious, most of the papules were beginning to be vesicular; the vesicles quickly began to dry up and scab, no true pustules appearing. The girl made a good recovery and was not permanently pitted.

Diagnosis.—The fact that smallpox is at times a very mild disorder makes it important that it should not be overlooked, inasmuch as a mild case as well as a more severe one may be the means of spreading the disease. Diagnosis is hardly possible in the absence of a papular eruption, or the purpuric spots of the malignant form.

Treatment.—The treatment is that of fevers generally.

Whooping Cough

Etiology, &c.—Whooping cough is an infectious disease which is characterised by a catarrh of the air passages and a peculiar spasmodic cough. It prevails in epidemics which are both widespread and prolonged, though sporadic cases are generally present in large centres of population. There is no disease which is more certainly infectious than whooping cough, in the sense that if those who are unprotected by a previous attack come in contact with those suffering from it they are almost certain to take it. If one member of a household is attacked, all the other members, both children and adults, who are unprotected, take the disease. If a enter a room or alley, it is tolerably certain that all the unprotected inhabitants will suffer. It is almost certain to spread in a similar way in a school or convalescent home. It is, however, a curious fact which we have often noticed, that whooping cough does not appear to spread to any great extent in hospital wards in which the children are in bed and the cubic space great (the same fact has been noticed by Dr. Sargès and Dr. Goodhart), and it would almost appear that close contact with the infected individual so as to inhale his breath was necessary to give the disease. It is impossible dogmatically to deny that the poison of whooping cough can be conveyed on the person or by clothes to a distance and so infect the healthy; but it is certainly exceptional; the common way in which it spreads is by direct contact with the sick. A very short contact is all that appears to be necessary—such, for instance, as a child meeting another for a moment in the street or in a shop; several instances of attacks contracted in this way have come under our

noticed. The epidemics, like those of measles, appear to occur in large cities every eighteen months or two years. It has been asserted that there is some definite relation between these two zymotics, as they frequently prevail epidemically together or one immediately preceding or following the other; it is very doubtful if this association is anything more than accidental, as they both are apt to recur every eighteen months or two years. The whooping cough epidemic lasts longer and more slowly reaches its height than the measles epidemic. Like measles, whooping cough seems to prevail at all seasons of the year; but, as one would naturally expect, it is more fatal in the colder months of the year than in the warmer months, in consequence of the broncho-pneumonia which is so apt to supervene if the child takes cold. The mortality is mostly high among very young and weakly children, while in older children it is rarely fatal. During the decade 1875-1887, 3769 cases of whooping cough were treated in connection with the children's dispensary, with 281 deaths, or a mortality of 7.6 per cent. Of these, 217 or 57 per cent. were under two years of age, 63 or 13 per cent. were from two to five years of age, and only one fatal case occurred in a child over five years of age. It is certain that these figures do not represent the total mortality, as they do not necessarily include those who die some months later of tuberculous and gastro-intestinal atrophy.

Incubation.—It is difficult to fix the latent period with precision, as the onset is gradual and the symptoms so often indefinite. It is usually seven to fourteen days before the child begins to cough, and another week or ten days before the characteristic 'whoop' is heard. This makes an interval of two to three weeks between being infected and commencing in 'whoop.'

Symptoms and Course.—The course of the disease is marked by three stages: (1) The catarrhal or premonitory stage; (2) The convulsive or *spasmodic* stage; (3) The stage of decline or *convalescence*. These stages, it is needless to say, are not well marked, but one gradually succeeds the other, and this is especially true with regard to the third.

The catarrhal stage begins with the symptoms of a feverish cold and tickling dry cough, which is not readily relieved by ordinary remedies. The cough is especially apt to occur at night, and it is remarked on by the friends as being more than usually troublesome, the child coughing and straining as if to relieve a persistent irritation in the throat. The cough keeps it awake at night, or it wakes up coughing and fails to get to sleep for some hours. During the day the child may appear well, or, on the other hand, the appetite fails and he looks pale and poorly. The cough, if not paroxysmal from the first, becomes so in the course of a few days, before the actual whoop is heard. There is usually some degree of fever at night, and dry rashes may often be heard on listening to the chest. The first stage may be complicated with bronchitis or pneumonia. In young children or infants the convulsive stage sometimes begins with a convulsion or series of convulsions.

The Convulsive Stage.—The cough now comes not only in paroxysms, but there is a distinct whoop; there are a number of short forcible expiratory efforts, as if an attempt was being made to expel some irritating matters, followed by the long-drawn characteristic inspiration which is technically called a 'hoop' or 'whoop,' or in some parts of the country a 'chink.' It is perhaps hardly right, at any rate when the second stage is well established,

to speak of the expiratory coughs as 'efforts'; the child, prompted by a peculiar tickling sensation in the throat, attempts to relieve it by coughing, but in a moment the coughing goes on in spite of any voluntary effort to repress it, so that the child's face becomes congested and the facial veins distended, before the inspiratory act takes place, and the air rushes into the air-passages and lungs through the narrowed glottis. Fit after fit of coughing will often follow one another, till the child vomits or a rush of stringy mucus, perhaps streaked with blood, pours out of its mouth and nose. In the worst cases the distress occasioned by these fits of coughing is extreme, and the child dreads their recurrence, not only on account of their discomfort, but from the aches and pains it suffers, by reason of the overstrained and weary respiratory muscles. To a weakly child the disease is necessarily a formidable one; the exhaustion produced by the constant muscular efforts, the frequent vomiting which prevents a proper amount of food from being assimilated, together with the intestinal catarrh which in a greater or less degree accompanies it, often reduce the child to a feeble and emaciated condition. It can easily be imagined that forty or fifty attacks of coughing every twenty-four hours produce great muscular exhaustion, and affect the child's vital powers. In milder cases, where the fits of coughing do not exceed twelve, the child may appear quite well between the paroxysms, and, though perhaps vomiting after the cough, it is quickly ready for another meal, with sharpened appetite. Fever is mostly present in the second stage in variable degree, especially at night. An examination of the chest will generally disclose bubbling rales in the larger tubes, the secretion being freer than in the first stage.

The Stage of Decline.—After a variable period of four to six weeks, during the latter portion of which the attacks of coughing have been diminishing, the characteristic whoop disappears, and convalescence may be said to be established. Mostly the paroxysmal character of the cough remains, and often the vomiting; gradually the bronchial catarrh disappears, and the cough ceases, though it is very likely to return, and the whoop along with it, whenever fresh cold is taken.

Complications.—By far the commonest is some form of **broncho-pneumonia**; **pleurisy** and **empyema** are not uncommon. There is nothing specially characteristic about the broncho-pneumonia of whooping cough; it is usually *double*, is very apt to be generalized rather than 'partial,' and tends to resolve, slowly passing into a subacute or chronic state. **Croupous pneumonia** is not uncommon in older children who take a chill during convalescence, and may be followed by empyema. **Empyema** and **atelectasis** are very apt to occur in connection with bronchitis in small andrickety children. Young children are sometimes convulsed, the convulsions being due to asphyxia, and perhaps **meningeal hæmorrhage**; drowsiness and coma are usually due to the same causes. We have seen a temporary **hemiparesis** arise during whooping cough. Cerebral symptoms, whether **convulsions** or drowsiness, are of grave import. **Intestinal catarrh** and **diarrhoea** of a mucous character are also common; the catarrhal condition of the air passages extends to the intestines, and large quantities of mucus are secreted, which prevent the digestion and assimilation of food and cause a rapid passage of the food through the intestines. The child passes small

morbid stools many times a day, is feverish and rapidly wastes. Sometimes the diarrhoea is of a dysenteric character. **Tuberculosis**, especially of the bronchial and intestinal glands, is a sequelæ rather than a complication, and usually follows some months later. A wasting during the third stage is either due to intestinal catarrh or chronic broncho-pneumonia than to tuberculosis. Among the lesser complications are ulceration of the firmum lingue, stomatitis, and sores about the nose and lips. Small conjunctival hemorrhages are very common. The child often remains for a long time in a weakly state of health, and may take long to regain its former strength. Permanent deformity of the chest may remain as a legacy left by an attack of whooping cough.

Diagnosis.—Often no diagnosis can be made in the early stages, and this is the more unfortunate as there can be no doubt that the disease is infectious during this stage. The fact that whooping cough occurs in epidemics will often aid us in coming to a conclusion. Difficulty may often arise in more chronic cases in which there is a paroxysmal cough followed by more or less of a stridulous sound, as in whether such are specific and are to go into quarantine. The diagnosis will turn largely on whether any cause for the sporadic cough can be discovered as well as on the history; if there has been previous wasting, and there is some evidence of tuberculosis of the lungs, enlarged mediastinal glands would be suspected as the cause of the sporadic cough. Diagnosis is often difficult in infants, as also it sometimes is in older children, who may have whooping cough without any characteristic 'whoop'; the 'whoop' may also cease when pneumonia supervenes.

Prognosis.—The fact that the mortality is vastly greater in children under two or three years of age than it is in older children must be borne in mind in forming a forecast of results. The prognosis in the case of an infant or a weakly child of eighteen months or two years of age is very uncertain, and death may occur suddenly during a fit of coughing from convulsions or spasm of the glottis. The prognosis is always rendered grave by the presence of broncho-pneumonia, the latter when it follows whooping cough is more local than when non-specific. Whooping cough during the winter months is always more likely to be complicated with chest disease than in the summer; and while this is especially true of the poorer classes, it holds good also to a lesser extent in the better housed classes of the population. The presence of rickets affects the prognosis unfavorably. The diagnosis between chronic broncho-pneumonia and tuberculosis and between chronic intestinal catarrh and metastatic disease is very difficult, but the tubercular diseases are much more likely to follow at a distance with a period of comparative health intervening, while the simpler forms are more likely to complicate or immediately follow. A chronic pneumonia often clears up, and the child recovers, and a urticaric intestinal catarrh may not improbably do the same.

Quarantine.—Six weeks is usually agreed as the time the infection lasts, dating from the commencement of the whoop; but in all cases it is wise to keep up the quarantine till all cough has ceased and the child is quite well. If the cough or even whoop menurates a period of undisturbed health, there is no fear of infection.

Pathology and Morbid Anatomy.—The epidemic prevalence of whooping

cough and its infectious character would suggest its cause being due to some micro-organism. Letrench and others have described such micro-organisms in the sputum of patients suffering from whooping cough; but it is doubtful if the actual specific bacillus has been isolated from the numerous micro-organisms found in the secretions of the mouth and fauces. From the observations of Von Heff and others who have watched the larynx with a laryngoscope during a paroxysm of coughing, it would appear that a small flake of mucus secreted from the posterior wall of the larynx was the excitant of the spasm. The entire larynx and trachea was, in a condition of catarrh, the greatest irritability being in the inter-arytenoid region and the under part of the glottis. Some believe that the nasal mucous membrane rather than the lower respiratory tract is the seat of irritation, and that it is here that local remedies should be applied.

No characteristic appearances are found on the *post-mortem* table; the lesions found will vary according to the mode of death. The brain is usually congested, especially the veins; there is often some subarachnoid fluid on the convexity and much fluid in the lateral ventricles. Various lesions may be found in the lungs, such as injection of the mucous membrane of the larynx and bronchi, with excessive secretion, emphysema, collapse, and various stages of broncho-pneumonia.

Treatment.—The most important part of treatment consists in confining the patients to well-ventilated rooms which are free from draughts and maintained at an equable temperature. Two large rooms should, if possible, be set apart for the treatment, the one occupied being maintained at a temperature of 60°, while the other is being thoroughly aired or disinfected, the latter being again warmed before the patients are removed. There can be no doubt that the attack is rendered more intense and protracted by rebreathing the infection as well as by a fresh catarrh being set up. Except in the warmest weather, the patient should be confined to his room in the house the whole time the disease lasts, as long as any 'whooping' is present, and as long as any rales or rhonchi are heard in the chest. Two great care cannot be exercised here; the bronchial tubes and lungs remain exceedingly sensitive to cold, and many severe attacks of pleuro-pneumonia have resulted both in old and young from a chill caught at outdoor games or from having gone to the seaside for change of air. Children are much better at home until well over the attack, not only for the sake of others but for themselves; and the pleadings of the friends for change of air must be stoutly resisted until six weeks at least from the commencement of whooping. With regard to medicinal treatment, there is no lack of remedies which have been tried, and no disease has been more ineffectually though diligently drugged. It is quite safe to say that no specific has as yet been discovered. During the catarrhal stage, when the cough is hard, the expectoration scanty, and there is fever, the best remedies include small doses of antimony, ipecacuanha, *ÿp. arsen.*, acetic, or citrate of potash. At night when the cough is especially troublesome hot mustard pedicels should be applied to the chest, and hot demulcent drinks, such as black currant tea, or barley water, or lemonade may be taken. Beef tea is often of service for the night, and a dose of hot brandy-and-water will sometimes induce sleep. The room should be kept moist with hot steam if there is much bronchial catarrh

or laeagitis. In the spasmodic stage, when the secretion is free, the expectorants should be stopped, and sedatives and small doses of narcotics substituted. At this stage the diffusion of carbolic acid vapour through the apartment is frequently of great service: this may be done by vaporising strong carbolic powder in one of Calvert's carbolic vaporisers; it is not certain how this acts: no doubt to some extent it soothes by acting as an anæsthetic to the fauces. In a similar way cocaine or reserpin may be used in the form of a spray or rubbed on to the fauces with a brush, but the effect is usually only temporary, as the anæsthesia produced by cocaine is too short to be of much service. Internally we are inclined to believe that antipyrin, antifebrin, and phenacetin are among the most useful remedies: from two to eight grains of the former being given every four hours according to age, and half this dose of the last two. Of other drugs at this period, belladonna, chloral, bromides, opium, cannabis indica, quinine, take the first place, but all at times fail to give any appreciable relief. Tr. belladonnæ is best given in small doses every four or six hours, increasing the frequency rather than the size of the dose. The combination of belladonna and cannabis indica is a favourite one: they may be combined as in F. 38.

The bromides and quinine dissolved in syrup of lemon with syrup of Santa Yerba is also a good combination. Croton chloral is highly praised by Dr. Webb; he orders a drachm of this drug to be dissolved in two ounces each of tr. camellani and glycerine, giving half a teaspoonful to two teaspoonfuls every four hours to children of one to ten years. Dr. Singer advises tr. lobelia, and gives doses of five to ten minims every hour even to young children. Opium is of all drugs the most certain to relieve; but it is perhaps best reserved to be given in one dose at night; one or five drops of tincture or half to two grains of Dover's powder will often secure a fairly good night. The bowels should be carefully attended to, and a laxative will frequently be required. Unless the secretion is very copious, poultices or fomentations in this stage give more relief than do liniments.

In the later stages, when the secretion is copious and the cough less and less spasmodic in character, nitric acid, alum, quinine, are most likely to be of service. Alum may be given with some sedative as, conium or hyoscyamus, the old formula of Golding-Bird's being a good one: Alum gr. $\frac{1}{2}$ ssii, conii ℥v, syrup. theobaldi ℥ss, aq. anethi ad ℥j: $\frac{1}{2}$ every four hours. Of external applications there are a goodly number which have been employed with varying success. Equal parts of lin. camph. co., lin. sapon., and lin. belladonnae, used cautiously on tender skins, make a good stimulating liniment. Some have great faith in oil of anise, as in the following: Ol. saccini ℥j, it. spū ℥ss, ut. camph. ℥ss, ol. amygdale ℥ss. The liniment of iodide of potassium and soap is useful. The diet both in the spasmodic and continued stage should be carefully arranged, and is difficult on account of the vomiting so frequently present. It will often be necessary to feed little and often to make up for food vomited. The complications, such as bronchopneumonia and intestinal catarrh, must be treated on the general principles given elsewhere.

Mumps, Parotitis.—Mumps is an infectious disease which is apt to prevail in epidemics; sometimes these extend over wide areas, though at other times cases occur and there is little tendency to spread. We have

never noticed an extensive epidemic in hospital, but the nurses are apt to catch the disease from children who have been admitted incubating mumps, and it would seem that close contact, perhaps inhaling the affected person's breath, was the commonest way in which an attack was contracted. It sometimes happens that there is no spread of the disease in the ward where the affected child was, but cases have occurred in other wards, the infection being carried by a nurse, or perhaps by a nurse who has herself had a slight attack.

Incubation.—According to Dr. Dukes, fourteen to twenty-five days. In some cases observed by us, it was fourteen, seventeen, and twenty-one days respectively.

Symptoms and Course.—Mumps is usually a mild disease attended by discomfort rather than serious illness. The attack usually begins with chilliness, stiffness about the jaws, local tenderness, often neuralgic pains; there is often no fever, sometimes the temperature goes up suddenly to 102° or 103°. The swelling is at first one-sided, involving the region of the parotid, which is prominent and tender; deglutition is difficult and painful. Both sides are usually swollen in a day or two, and the patient presents a characteristic appearance. The fauces and tonsils are normal. While the parotids are usually affected, in some cases the swelling is entirely confined to the submandibular salivary glands on one or both sides; it is in these cases that the nature of the attack is likely to be overlooked. The attack lasts, as a rule, from a few days to a week. *Ochritia* occasionally occurs in boys about puberty. *Hemiplegia* has been known to follow (Gowers).

Diagnostic.—We have known cases of mumps sent into a scarlet fever ward as cases of scarlet fever, and we have also seen a case of tonsillitis with enlarged cervical glands, probably scarlatinal, which was diagnosed as mumps. In all cases of doubt as to the nature of the external swelling, the appearances presented by the tonsils should be decisive. The swelling due to mumps in the majority of cases corresponds to the parotid region, the swelling of cervical glands secondary to tonsillar affections is at the angle of the jaw or just behind it. There is rarely much fever or illness with mumps; in diphtheria or scarlet fever, where there is much external swelling or cellulitis, the child is evidently gravely ill, and if a satisfactory view of the fauces can be obtained, they will be seen to be swollen, ulcerated, and perhaps covered with exudation. In adenitis, attended by fever, it is the lymphatic glands rather than the parotid which are affected. In spite, however, of these distinctions, difficult and doubtful cases may occur.*

Treatment.—Not much is required except hot fomentations or belladonna tincture to the parotid regions, and a saline followed by a tonic. Three or four weeks, according to the severity of the case, should elapse before the patient returns to school or mixes with his fellows.

Malarial Fever.—Children who live in malarial districts suffer from malarial attacks as frequently as do adults; indeed, according to Holt, they are peculiarly susceptible. In this country many opportunities do not occur of seeing the disease in its early stages; the cases which mostly come under observation are those which are chronic, having acquired the disease

* Suppuration in a parotid gland may take place in mumps or scarlet, but this may hardly be mistaken for mumps.

abroad and having been invalided home. In these cases marked anemia with enlarged spleen, and perhaps intermittent fever, form the commonest symptoms. The anemia is frequently profound and the spleen attains to an enormous size. Nephritis as a sequel of agueish attacks is sometimes seen in this country. Such a case we saw with Dr. Marshall, the attack having been contracted in Brazil; there was marked anemia, enlarged spleen, the urine was highly albuminous, and contained tiny and glomerular casts. According to Lewis Smith, intermittent fever when it affects those over 50 years differs little from the adult form, while below that age it presents some peculiarities. Malarial fever may be hereditary, being derived from the mother. In one case, recorded by Lewis Smith, an infant showed distinct symptoms a week after birth; the mother had suffered from tertian ague at intervals during the two years prior to her confinement. In the infant the type is quotidian, rarely tertian; there are three stages presented by an attack; the second or febrile is well marked, the temperature rising to 104° to 106° ; the first and third less so. The spleen soon enlarges, and after a week or two, if the attack continues, there is marked anemia. The enlargement of the spleen fails to take place in some of the cases. Dr. Emmet Holt, of New York, is making an analysis of the symptoms of 182 cases of malaria in children, has pointed out how much more insidious the invasion of the disease is in children than in adults, and consequently there is more liability to overlook it and attribute the symptoms to other causes. Even the periodicity of the recurrence may not be regular, which would still more throw the physician off his guard. In his cases with a gradual invasion he noted anemia, frontal headache, constipated bowels, muscular weakness, vomiting, furred tongue, drowsiness, and epigastric pains; these symptoms usually recurring in the afternoon. The spleen was enlarged, but these were exceptions to this. The fever noticed by this author assumed three types: the first in which the fever remained high for twenty-four to twenty-two hours, when a marked remission took place, the temperature then assuming a remittent type; secondly, the fever is at first slight and only present at one period of the twenty-four hours, but gradually increases in intensity and assumes a remittent type; thirdly, assuming a distinctly remittent or intermittent type from the outset. Cerebral symptoms are common; there are frontal headache, drowsiness, and apathy, occasionally convulsions; pains in various parts of the body; various spasmodic disorders, as torticollis and motor paralysis, are less common, but sometimes take the form of paraplegia. Dr. Holt has also pointed out that the malarial poison may complicate and modify other diseases; of these bronchitis and pulmonary congestion are common, the latter closely resembling pneumonia in the onset, but subsiding in a few hours, to come on again in the course of twenty-four hours. Spasmodic anthera of malarial origin may occur. Various gastro-intestinal disorders, as vomiting and diarrhea, occur periodically at a certain time daily. The diagnosis in these cases depends upon: (1) Periodicity of the symptoms; (2) the co-existence of splenic enlargement; (3) failure of the usual remedies to relieve; (4) their prompt disappearance under the use of antiperiodics.

Treatment.—The treatment consists, as in adults, in the administration of antiperiodics, such as quinine, cinchocaine, and arsenic.

CHAPTER XIV

DISORDERS OF THE CIRCULATORY SYSTEM

Diseases of the Heart

Physical Examination.—An examination of the heart includes an endeavor to determine its position, size, and the character of the cardiac sounds. It is needless to say that the younger the child, the more difficult it is to make a satisfactory examination. The first point to determine is the position of the apex beat, and as this gives us important information for making a diagnosis, it should never be neglected. If not visible its position may usually be felt by laying the extended hand on the cardiac area, and note must be made as to whether it occupies a larger space than normal, and whether it is accompanied by a thrill. The usual position of the cardiac impulse in adults is in the fifth interspace and well within the left nipple line. Syrington has shown, by a number of frozen sections of the thorax at different ages, that during childhood the apex beat is apt to take a more external position as regards the nipple than in later years, a result due to the greater relative narrowness of the child's chest in the transverse diameter. As a matter of fact, it is usually well within the nipple in most children according to our observations, but we must not hastily come to the conclusion that because we may find in a given case it is actually in a line with the nipple that disease is present. If external in position to the nipple we should always be suspicious that there is an abnormal displacement of the heart to the left, or there is some dilation of the left ventricle.¹ If the impulse is raised it would suggest that it was displaced upwards by a distended stomach or other abdominal enlargement, or there is chronic lung disease of the left apex, or possibly pericardial effusion. If the impulse is displaced to the right there is in all probability fluid in the left pleura. Epigastric pulsation in a case of chronic heart disease generally means dilation of the right ventricle. A heaving angular lower than normal, the chest wall being lifted during systole, suggests hypertrophy of the left ventricle, a diffused weak impulse implies dilatation.

In mapping out the size and position of the heart by means of percussion we necessarily take the 'deep dullness' as our guide, but as the cardiac dullness shades away laterally into the pulmonary resonance, great care must be taken in the determination. Let us bear in mind that the shape and elasticity of the chest walls may modify the percussion note, and this is

¹ See also under the conclusion that in most children the cardiac impulse is in the nipple line, and in some instances one cm. external without indicating disease.

especially true in percussing over the lower half of the sternum. Some writers have laid down rules as to the limits of the cardiac dullness in children of various ages. We doubt very much the correctness of some of the statements which have been made, and we should recommend the student to bear in mind only the limits which he has been accustomed to observe in the wards of an adult hospital, but not forgetting that an extension of dullness to the left more than in the case of adults does not necessarily mean a pathological condition. The upper limit of the heart is the upper edge of the third left costal cartilage; dullness extending higher than this suggests fluid in the pericardium, an enlarged heart, or a lesion at the left apex of the lung. The left border of the heart should lie within a curved line drawn from the junction of the third left costal cartilage with the sternum, extending downwards and to the left to the fifth space just within the nipple line. The right border corresponding to the right auricle should lie within a line drawn from the above point curving downwards and outwards along the right edge of the sternum. Inferiorly the cardiac dullness cannot be distinguished from the hepatic dullness. In chronic disease the chest wall is frequently bulged over the cardiac area, while the dull area is extended both to the left and right, and may even measure as much as 6 inches across from side to side. We will defer reference to the cardiac sounds till later.

Congenital Heart Disease

The different forms of malformed hearts are exceedingly numerous, and defy any attempt at classification, but so many of these, though of great interest to the anatomist as illustrating the various stages of development, are of little practical importance to the clinician, no detailed description is needed here. The principal causes at work in producing these malformations may be classified as follows: (1) Persistence of fetal openings, more particularly the foramen ovale, in consequence of the lungs remaining in part in the fetal state after birth; there is obstruction through the lungs and overfilling of the right heart. (2) Endocarditis, occurring during fetal life, affecting the pulmonary, the tricuspid, and less often the aortic or mitral valves, producing stenosis at the valvular orifice, and as a secondary effect the persistence of the foramen ovale, or ductus arteriosus; or the septum ventriculorum may remain incomplete. (3) An arrest of development at some period of fetal life or the results of a false step, as it were, as when a transposition of the aorta and pulmonary artery occurs.

Congenital heart disease not infrequently occurs in several members of the same family; in one case coming under our notice, where there were four children two sisters and one brother were thus affected.

Symptoms.—Cyanosis and the presence of a bruit are the only reliable signs of congenital heart disease. Cyanosis is rarely, but not universally, present, and it varies considerably in intensity. It is most marked, and is sometimes only present, when the infant cries, the face being dusky, the lips and tongue and extremities becoming of a bluish tinge. We must, however, bear in mind that some cyanosis may be present in prematurely born infants when the lungs are but partially inflated, and remain in the fetal state, and often atrophic and feeble infants have blue and cold hands and feet. If,

however, the cyanosis persists for many weeks, it is probably due to malformation of the heart. In a certain proportion of cases murmurs are heard. These are apt to be of a rough, rasping, superficial character, and the rhythm is often exceedingly difficult to determine, on account of the rapid action of the infant's heart. The differential diagnosis is very frequently impossible, and only a sort of guess can be made. The position of greatest intensity should be determined; but this is not always easy, as many of the murmurs are so loud that they are heard all over the chest. Note should be taken as to whether the bruit replaces or is only heard through, as it were, the heart sounds. A thorough examination cannot, perhaps, be made at first, as it is unwise to expose a weakly infant too much, and, moreover, the possibility of a pericardial friction sound in newly born infants must not be forgotten. Any external congenital malformation would suggest that the heart defect was the result of some arrest of development or some abnormal development rather than due to endocarditis.

The prognosis is, of course, bad, but much uncertainty must necessarily exist, as the diagnosis of the exact form of lesion present often cannot be made. The more cyanosis present the worse is the prognosis, as, in infants at least, there is a great liability to meningeal hæmorrhage taking place, either slowly or during a fit of crying, vomiting, or coughing. Convulsions may at any time supervene and quickly prove fatal. The venous state of the blood interferes with the secretion of the digestive juices, and the whole system is worked at a disadvantage. In older children the amount of hypertrophy and dilatation must be taken into account in making a prognosis; the larger the heart, the nearer is it to the end of its tether. The extent to which clubbing of the fingers is present must also be considered.

Patent Foramen Ovale.—The foramen ovale allows of the passage of blood from the right to the left auricle during fetal life (see fig. 51), but closes up shortly after birth if there is no obstruction to the circulation of blood in the pulmonary system, and consequently increased blood pressure on the right side of the heart. If, on the other hand, the lungs are only partially expanded, remaining in part in the fetal condition, a portion of the blood which under normal conditions would enter the pulmonary circulation escapes it by passing directly from the right heart to the left through the foramen ovale. Reported attacks of bronchitis after birth may have a similar effect in preventing the closure of the foramen ovale. The further history of such cases is uncertain, but there is reason to suppose that, if the child remains free from pulmonary trouble, the foramen ovale may close, or at least allow of but little mixture of the blood of the auricles, and be therefore of but slight detriment to the patient. It is not uncommon to meet with such cases in children a year or two old, who come under medical treatment for bronchitis, and in whom a loud systolic basic bruit is heard, which varies in intensity according to the amount of pulmonary trouble present. In one of our own cases, a child of thirteen months, there was much bronchitis, asthma, and indiana; the child recovered for a while, but died of diphtheria nine months later. The *post-mortem* showed the foramen ovale to be the size of a shilling, partly closed by membranous bands crossing it; possibly these had produced the bruit heard during life. The pulmonary artery was dilated. An open foramen ovale is usually present in cases where there is stenosis of

the pulmonary artery or tricuspid orifice. The murmur produced by the passage of blood through an enclosed foramen *ovale*, is heard best at the base of the heart in front, and is also heard well behind. Its position the foramen lies at the posterior aspect of the heart, on a level with the fifth costal cartilage.

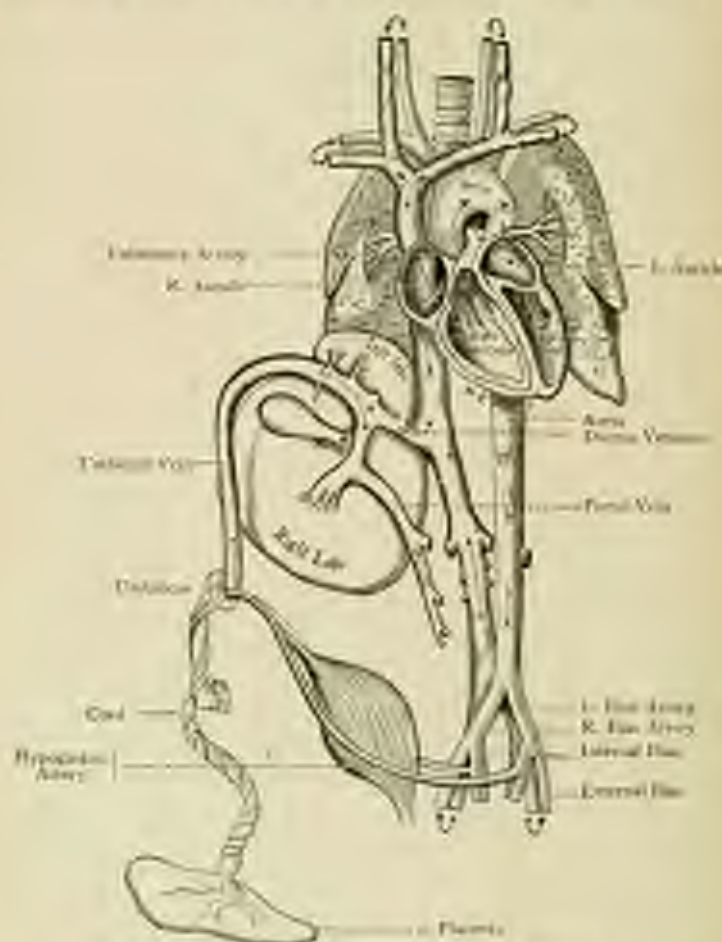


Fig. 41.—Plan of Fetal Circulation (Gray's Anatomy.)

lage, where it joins the vena cava, being behind the sternum and somewhat to the right. Posteriorly it lies just in front of the seventh vertebra. There may be an open foramen and yet no bruit be heard, as, if there is no pulmonary obstruction, there may be little or no rush of blood through the orifice. As the passage of blood from auricle to auricle takes place during the auricular

apulse, presumably the beat should be 'presystolic' in rhythm, immediately preceding the first mitral sound. It can readily be understood that it is not easy to distinguish between a presystolic and systolic beat in an infant or young child, especially if there is some pulmonary trouble.

It is not uncommon to find a more or less open foramen ovale in older children. In one of our cases, a boy of ten and a half years who suffered from chronic heart disease and had had several attacks of rheumatism, we found *post mortem* a large dilated heart with a much thickened pericardium, an abnormally small aorta only admitting a little finger, an open foramen ovale, and a thickened and puckered mitral valve.

Patent Septum Ventriculorum.—Unlike the inter-auricular partition, the septum between the ventricles becomes complete during fetal life, usually during the third month. If, however, there is any obstruction at the pulmonary orifice, or any malformation which renders unequal the pressure of blood in the two ventricles, the ventricular septum remains incomplete and allows of the passage of blood from one ventricle to the other. The spot which remains open, or is the last to close up, is the so-called 'undefended spot' at the base, where the septum intervenes between the mitral and tricuspid valves, and is normally the thinnest and most membranous. An incomplete septum is usually associated with pulmonary obstruction, or is found in cases where the aorta arises from both ventricles, or where there is transposition of the great vessels. In some few cases it appears to be a primary defect arising from arrest of development or some unknown cause. In such cases the child may live several years, the heart becoming enlarged, more particularly on account of the left ventricle undergoing dilatation and hypertrophy in its efforts to maintain sufficient tension in the arteries during the systole, while under the disadvantage of its contents being in part forced into the more feebly acting right ventricle. The murmur produced is loud and rough, replacing the first sound; it is heard loudest over the lower part of the sternum, but is well conducted to the seat of cardiac impulse. It is also, if loud, heard both in the axilla and posteriorly.¹

Stenosis of the Pulmonary and Tricuspid Orifices.—If an endocarditis occur during fetal life, especially during the early period, it is apt to affect the pulmonary and tricuspid valves, the liability of the valves on the left side being greater towards the end of fetal life, as more and more work is imposed upon the left heart. In some cases a complete stenosis of the pulmonary and tricuspid orifices takes place, the heart becoming trabecular. Thus in the case of an infant, markedly cyanotic during life, but who lived for four months, it was found that the pulmonary orifice was completely closed, the tricuspid only admitted a crow's bill, and the right ventricle was contracted and distensive. There was an open foramen ovale, and the pulmonary circulation had been maintained by an open ductus arteriosus, the lungs being thus supplied by the aorta. In other cases where the stenosis of the pulmonary artery is only partial, the patient may live for years or even reach adult life; there is usually an open foramen ovale, or ductus arteriosus, or defective inter-ventricular septum; cyanosis is mostly present, of a more or less high grade; the child easily gets out of breath, is backward in talking and

¹ See case reported by Huxton in the *Abstracts, Children's Hospital, Philadelphia*, Aug. p. 43; and Keating and Edwards, *Arch. of Pediatrics*, p. 124, 1887.

getting on its feet, and is incapable of any great amount of exertion. The murmur present is usually loud, superficial, and rasping, being best heard over the pulmonary valves, over the second left costal cartilage near the sternum. There may be signs of dilatation of the right ventricle, such as epigastric pulsation.

This is perhaps the commonest form of congenital heart disease found in children who have survived infancy and early childhood. Such children may live to grow up, but are apt to suffer from tuberculosis or to be carried off by bronchitis or pneumonia. Post-natal endocarditis is sometimes superadded. The diagnosis is not always easy between pulmonary stenosis and open foramen ovale without other lesion, especially as the bruit heard may result from the presence of both lesions. In pulmonary stenosis there

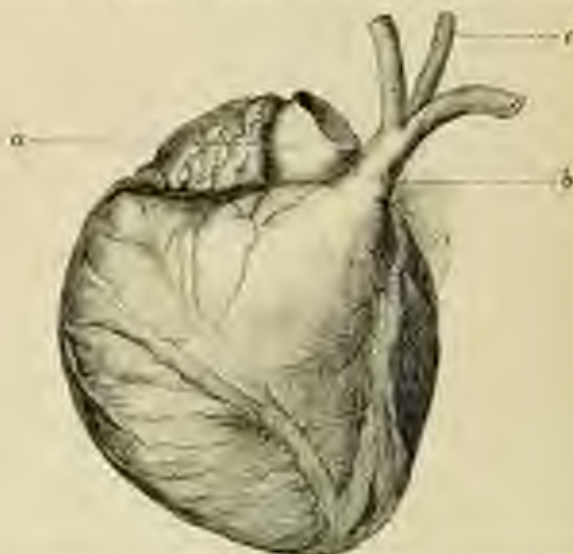


Fig. 30.—Congenital Heart Disease, from a child aged six months. Stenosis of the pulmonary artery. *a*, aorta; *b*, pulmonary artery; *c*, *d*, post-natal atherosclerosis.

is more likely to be cyanosis and a dilated right ventricle, and the murmur to be confined to and heard loudest in the pulmonary area. Cadet de Gassicourt has reported a case where a bruit was produced through enlarged glands pressing on the pulmonary artery.

Stenosis of the Aorta or Mitral Valves.—In some cases there appears to be a congenital smallness of the aorta and arterial system, though it most probably is the result of undergrowth being secondary to some other cardiac lesion, by means of which the arterial system is imperfectly supplied with blood. An endocarditis occurring late in fetal life sometimes affects the aortic valves, and an endocarditis may also occur after birth, and still farther deform or pucker the valves. In such cases, if there is marked obstruction at the aortic valves, the ductus arteriosus may remain open, and some of the

blood may pass, as it does during fetal life, from the pulmonary artery into the aorta, without passing through the lungs. The left ventricle will become hypertrophied. When the stenosis is only moderate, life may be prolonged for many years. Stenosis of the mitral valve may also occur.

Transposition of the Aorta and Pulmonary Artery.—This curious malformation is not uncommon; the foramen ovale and ventricular septum remain open. Life is rarely prolonged for more than a few months; there is much cyanosis, but no crust is present. A diagnosis during life is hardly possible. Of the many other malformations or arrests of development, such as a heart consisting of single auricle and ventricle, or a three-chambered heart, it is unnecessary to speak.



Fig. 11.—Same heart as Fig. 10. Right ventricle opened. *a*, aorta arising from both ventricles; *b*, pulmonary artery, subcostal branch only, about a large probe; *c*, homophere interventricular septum; *d*, coronary veins.

Diseases of the Pericardium

In a few cases a congenital absence of the pericardium or some defect in the pericardium has been recorded. In some cases a hernia or diverticulum has been present; these congenital defects are of little practical interest.

Pericarditis

Etiology.—In children, as in adults, the most important association of pericarditis is with rheumatism, acute or subacute, as it arises more often during a rheumatic attack than under any other condition. An exception to this however occurs, for in children under three years of age rheumatism is an uncommon ailment, and pericarditis when present is most frequently the result of an extension of the inflammation from a pleuro-pneumonia or myxema, or arises in association with such attacks. It is by no means

uncommon to hear a pericardial friction sound during an attack of pericarditis in young children, or perhaps to discover *post mortem* that a pericarditis has taken place in a case which was looked upon during life as one of simple broncho- or pleuro-pneumonia. In such cases, if they recover, a chronic pericardial effusion may remain after the pulmonary lesion has been recovered from.

Pericarditis occasionally occurs during an attack of scarlet fever, either associated with synovitis, or it may be in the absence of any joint complications. It occurs also during the course of post-scarlatinal sepsitis, as a result of a uræmic condition, and under such circumstances must be looked upon as of extremely evil augury. It may occur during septicæmia, to whatever cause this may be attributed, or in pericarditis *acuta* and *chronica*, and we have known it supervene in an attack of influenza.

Pericarditis occurring in a child over three years of age is most frequently associated with the rheumatic state. Not that it only occurs during an attack of acute rheumatism, for it may supervene when there is no joint pain whatever, or when the joint pain is slight; but it occurs in a rheumatic individual, one who has already suffered from an attack, or who suffers from some of the associations of rheumatism, such as chorea, erythema nodosum, or endocarditis. Pericarditis is apt to crop up in an unexpected and unexplained manner, and it should be carefully looked for whenever indefinite pectoral or epigastric pain is complained of. It must be borne in mind that, like pleurisy, it occurs in an extremely mild form; a pericardial rub may be heard unexpectedly in the absence of any definite symptoms in children who are going about and make no complaint of pain or dyspnoea. These attacks pass away, and presumably leave more or less of adhesions between the visceral and parietal layers of the pericardium. Does pericarditis recur? No doubt it does, in spite of fibrous adhesions and damage to the serous layer by former attacks.

Cases of pericarditis occurring during fetal life have been recorded by Biffard, Bodnar, and others. It also occurs in the septiciæmia of the newly born, secondary to an inflammatory condition of the cord.

Symptoms.—The subjective symptoms are usually ill defined, especially in young children, and are of comparatively little importance as helps to diagnosis. The signs and symptoms mostly to be relied on are: (1) The presence of a pericardial friction sound. (2) An increased area of cardiac dullness proportionate to the effusion present. (3) The disappearance of the apex beat, or the position of the apex beat is raised and its area extended. (4) There is heart pain and perhaps tenderness on pressure over the cardiac region. (5) A pericardial friction sound can hardly be overlooked if carefully listened for, and is not likely to be mistaken for valvular murmurs, except, perhaps, in the case of infants the subject of congenital heart disease, the murmur in such cases being often harsh and superficial. It must not be forgotten that the presence of a friction sound is not incompatible with a large amount of effusion into the pericardial sac. It usually, however, disappears as effusion takes place, and reappears as the liquid becomes absorbed. (6) As effusion takes place into the sac, the area of cardiac dullness is necessarily increased in proportion to the amount of fluid present. The pericardium of a healthy child (age 6-9 years) when fully distended contains,

according to Simon, about 5 cc.,¹ but much larger quantities than this are often present: the effect of the distension of the sac with fluid is to increase the cardiac dullness laterally, and in an upward direction, the lungs, especially the left, being pushed on one side, so that the dullness extends to the second left costal cartilage, or even as high as the clavicle, and over a corresponding portion of the sternum. In lesser effusions the fluid tends to accumulate in the lowest part, and so modifies the dullness in a lateral direction. (3) The cardiac impulse disappears and the sounds become faint if the effusion is large, as a layer of fluid is interposed between the heart and the chest walls. Instead of the apex beat disappearing, it may be diffused and raised so as to be palpable or visible in the third and fourth spaces, as pointed out by Simon. (4) Pericarditis may take place without any complaint of pain on the part of the patient, and hence may be easily overlooked in a mild case. In severe cases the pain is referred to the cardiac region, and pressure with the fingers or stethoscope causes pain.

The discovery of a friction sound is usually the first thing to call attention to the attack. There may be only a slight rub or a loud grating sound heard all over the chest. At this stage, where there is no fluid present, presuming there is no valvular disease or dilatation, there is no, or but little, dyspnoea, probably more or less pain in the chest, quickened pulse and moderate fever. The amount of fever present is variable, seldom very high—101° F. to 103° F. in a severe case; the temperature usually falls by 1° or 2° towards the end of the week. The rub may disappear in a few days in consequence of adhesions being formed. On the other hand, the friction sounds may entirely or in part disappear in consequence of effusion taking place; as the effusion increases dyspnoea becomes more marked; at first it is slight, but if the effusion becomes large the dyspnoea increases, coming on in paroxysms accompanied by cyanosis, and there is perhaps a small, irregular pulse. It must not be forgotten that a considerable effusion may be present, and yet a loud friction sound be heard, caused by a small portion of the roughened layers of pericardium coming in contact. Death may be sudden at this stage, especially in those cases where pericarditis supervenes on old heart mischief, and the cardiac walls have become degenerated. In other cases the fluid is gradually absorbed, the friction is again heard more or less intensely and finally disappears as adhesion takes place.

No inflammatory affection differs more in intensity than rheumatic pericarditis. There is little doubt that slight attacks occur which are overlooked, for a pericardial friction sound is heard at times when least expected, and disappears again without producing any symptoms of importance, or without the child having been ill, or it may be discovered during an intercurrent attack of scarlet fever or pneumonia. On the other hand, acute pericarditis, or 'acute carditis,' as Dr. Sturges has called it, is a severe and dangerous affection, especially when it supervenes in patients whose mitral valves have been damaged by attacks of endocarditis, and dilatation of the heart cavities has occurred. The damaged heart has, when surrounded by lymph and fluid, to struggle with an increased load, and no wonder the prominent feature of the attack is cardiac failure. In these severe cases

¹ In enlarged hearts in this age, the pericardium may contain two or three times this amount.

there is a quickened and perhaps irregular and intermittent pulse, orthopnea, coughing, with an anxious and worn expression of face. In the worst cases, when the effusion of fluid is great, the patient has an ashen or cyanotic look, he sits up in bed leaning forward, and bringing all the extra muscles of respiration into play in the struggle for breath. Oedema of the extremities, ascites, and pleural effusion may be present.

In the slighter cases of pericarditis, loose adhesions or attachments may take place between the two layers of the pericardium. The result of a single attack may be unimportant, but if there are repeated attacks, and they are severe, tough and thick adhesions are formed. The heart is thus surrounded by a thick fibrous coat, perhaps one-eighth to a quarter of an inch in thickness, which clogs and impedes the systole of the ventricles. Gradual distention of all the cavities takes place with thinning of their walls. This condition of things is naturally made worse by an endocarditis, which thickens and deforms the mitral and perhaps the tricuspid valves. Thus, as an illustration of these results, we may refer to the following case. A girl of twelve years, who had suffered from chronic heart disease for some years; at the *post-mortem* the heart with the smoothed pericardium and contained the weighed twenty-two ounces, the pericardium was thick and adherent and leathery, all the cavities were dilated, the mitral valve had suffered from old and recent endocarditis, the tricuspid orifice and the pulmonary artery were abnormally wide, the aorta was small, just admitting the little finger, and indeed the aorta and its branches were no larger than those of a child of three years. No doubt in this case the aorta had failed to develop normally on account of the small amount of blood which passed through it.

An effusion into the pericardium, like an effusion into the pleural cavity, may be chronic. It sometimes happens, as we have already pointed out, especially in young children, that a pericardial and pleural effusion takes place, the latter becomes absorbed, and adhesions form, while the pericardium remains distended with fluid. If the child is seen for the first time when this has occurred, an error in diagnosis is very easy, as the distress caused by a distended pericardium shades away into the impaired resonance given by a compressed and adherent left lung. We have several times seen in young children fluid aspirated from the pericardium by a needle passed into the axilla, when it was believed the fluid was being drawn from the left pleural cavity. In these cases, it was found at the *post-mortem* examination the needle had passed through the compressed left lung and entered the distended pericardium.

A chronic pericardial effusion is sometimes present in tubercular subjects, after the manner of a peritoneal effusion; this may be of long standing, and the diagnosis may be difficult, as the effusion may be associated with a mediastinitis and may suggest the presence of mediastinal tumour. This was so in the following case:

Chronic Pericarditis and Peritonitis, Contracted Mitral, General Mitral Failure.—John H. P., aged 7 years. Mother states he has always been a healthy boy till five months ago, when he had bronchitis; has been wasting ever since; his belly has been swelling since. Admitted August 27, 1881. Is an emaciated, bony boy, with distended abdomen, evidently containing much peritoneal fluid; right side of chest is normal; the left is quite dull in front, reaching to the axilla above, and shading away

in the stomach resonant and into muffled, which is also resonant; the whole cardiac area is included in the dull area; the dullness extends to the right just beyond the right sternal line; posteriorly the pericardium more is normal; over the dull area there is bronchial breathing both with and without vocalization; there are no rales or sounds; the cardiac impulse is not visible or palpable; cardiac sounds normal; the veins on the chest are enlarged and tortuous; there is marked oedema; the liver is enlarged; the spleen not felt; urine not abnormal. September 24.—They continue quiet in same state; less motion; the temperature continues normal or subnormal; he does not appear to be in any way uncomfortable; the glands in the neck under jaw are enlarged. November 11.—Went home for a while. Resolved until December 20, 1886. Has been fairly well at home, except he has had cough and his belly has swollen more; physical signs in chest much the same; there is, however, more dyspnoea; the face has a bluish tinge, and the superficial veins on chest more distended; exploration of chest in dull area with a hypodermic syringe some straw-coloured coagulable fluid like serum was withdrawn. January 22.—Has been getting worse for some weeks past; temperature has risen December 13 been 99°-100°-101°; the physical signs have not materially altered except there is more increased resonance now at base of left lung behind. January 24.—Has been coughing; pulse 96; irregular and intercurrent; temperature 101°-102°. January 25.—Continues to resist; the action has much diminished. Died January 26. Post-mortem.—Some emaciation; some bulging over cardiac area; on opening chest it is seen the pericardium is distended, pushing the left lung away to the left out of sight, the edge of the right lung partly overlapping pericardium; there is a complete matting together of the pericardium and mediastinal glands with excess of fibrous tissue; the mediastinal glands are enlarged, containing milky tubercles; some are shrunken and pigmented; the right lung is normal; the left is compressed, surrounded by old adhesions and covered milky tubercles; on section it is confirmed; recent pulmonary apoplexy; the pericardium is adherent to the parts around; on cutting into it its walls are nearly 1 inch thick, it contained 2 or 3 oz. of serum and much loose granular lymph; heart somewhat small, lymph on the surface; aortic valve only admits four-fifths, tricuspid 2/3 fingers; edges of aortic valve hard and sclerotic; left auricle wall thickened; left ventricle cavity small; right ventricle dilated; a few masses of fluid in pericardium; numerous indurated covered with recent milky tubercles; large and small intestines covered with milky tubercles; no ulcers internally; liver adherent to the diaphragm and covered with milky tubercles; cottony lity; kidneys, a few cheesy tubercles; spleen normal; brain, lymph in Sylvian fissures, around cerebellum, and in interpeduncular space; fluid in the ventricles; indurated on the vessels.

Chronic pericardial effusions are apt to become purulent, and in rare cases the pus may find its way to the surface after the fashion of an empyema; this happened in one of our own cases, a child of eighteen months, the abscess pointing near the tip of the sternum; after the abscess was opened the child died of exhaustion, and the diagnosis was verified *post mortem*. In such cases there is much difficulty in deciding as to the origin of the pus; so to whether the abscess pointing is a collection of pus finding its way out from the mediastinum or from the pericardium. It may also be a local empyema or pericardial abscess.

Complications.—In rheumatic pericarditis, endocarditis is exceedingly likely to occur during the attack. Pleurisy or pleuro-pneumonia may be present; more rarely peritonitis and meningitis.

Diagnosis.—A pericardial friction sound is not likely to be confounded with anything else, unless, perhaps, it is an extra-cardiac sound, such as is produced by the external surface of the pericardium rubbing against a roughened pleura; but this latter is heard only, or at any rate more loudly, during inspiration. The difficulty most likely to occur is, in a case in which there is admittedly old cardiac mischief, to distinguish between stiffness due to the

presence of fluid and that due to a dilated heart. To anyone who has carefully watched a case from the commencement of the heart disease this difficulty may be small; but in cases which are suffering from great dyspnoea and distress, in which pericarditis and dilated ventricles exist together, it is often difficult to decide when the child is seen for the first time what amount of fluid is present and what share it takes in the production of the cardiac distress. It must be borne in mind that if the amount of fluid is excessive, there is dullness as high as the left second intercostal space. In a large dilated heart there will be bulging of the chest walls, and an extended area of pulsation in part outside the left nipple line. It has been pointed out by several writers (Roth, Dickinson) that dullness extending into the right fifth interspace is probably due to fluid.

Endocarditis

Inflammation of the membrane lining the heart, more especially that part which covers the valves, occurs at all periods of life. It may attack the fetus, and then usually affects the pulmonary or mitral valves; but if it occurs in the last few weeks of fetal life it may affect the mitral and aortic valves. It may also occur during the two or three years succeeding birth; it is, however, less common at this period than later, though it is probably often overlooked. It is common during the later periods of childhood and youth. Like pericarditis, its usual association is with the rheumatic state, not that there is necessarily marked tenderness of the joints and high fever, but the patient exhibits some of the symptoms or associations of rheumatism, such as chorea, or erythema nodosum, or he has suffered from undoubted joint troubles in the past. During an attack of rheumatism, children are especially prone to suffer from endocarditis, and the proportion of those who do suffer is greater than in the case of adults, being in the case of children perhaps 75-80 per cent.; in adults the proportion must be far less than this. Endocarditis also occurs in scarlet fever; the heart does not, however, so often suffer here as in simple rheumatism. In septicæmia, in pyæmia, and during attacks of any of the septic fevers, especially diphtheria, endocarditis may occur. In all febrile conditions a difficulty may arise in the diagnosis, or in distinguishing murmurs due to organic disease from toxic murmurs. During fever the circulation is disturbed and the cardiac beats increased in number, the first cardiac sound being wanting in sharpness, or there may be a 'murmurous' sound heard; if this disappears during convalescence we are hardly justified in saying that an endocarditis has existed. That endocarditis does occur at times during an attack of scarlet fever or during convalescence is certain; it is, however, rare to find the valves affected in a fatal case of scarlet fever.

Malignant or ulcerative endocarditis arises in some instances in connection with the rheumatic state, being engrained on to an ordinary rheumatic endocarditis; it occurs in connection with acute nephritis, suppurative peritonitis and osteomyelitis. It appears sometimes to follow scarlet fever. Recent observations have shown the presence of septic microorganisms, such as streptococci *gr.*, staphylococci, and Fraenkel's pneumonia diplococci on the valves in malignant endocarditis, and it would appear as if a simple endocarditis afforded a suitable soil for the development of these

pyogenic micro-organisms. We have several times got cultivations of streptococci on gelatine from blood drawn from the finger in cases of malignant endocarditis.

The symptoms of simple endocarditis, such as occurs during rheumatism, are not distinctive. There is often precordial pain, perhaps some dyspnoea, usually some fever of an intermittent type (see fig. 54), though this, in some instances, may be due to the rheumatism present; indeed, the only symptom upon which any reliance can be placed is the presence of a bruit; it is certain, however, that endocarditis may exist without a bruit being present. It sometimes happens that during an attack of rheumatism or chorea the most careful examination may fail to detect a bruit, and yet, if the patient is examined a month or two after, a bruit is detected, which comes rather as a surprise. In the vast majority of cases it is the mitral orifice which is affected, a murmur being heard which replaces or accompanies the first sound at the apex. Dr. O. Sources points out that in some cases a faint murmur heard at the top of the costal cartilage, indicating regurgitation



Fig. 54.—Temperature Chart of a case of Endocarditis supervening on the sixth day of a mild Rheumatic Fever; there were no joint lesions, the bruit persisted, and dilatation of the left ventricle followed.

at the tricuspid orifice, precedes the mitral bruit, the tricuspid regurgitation being due to back pressure through the lungs. The constitutional disturbance is but slight, or at least it is impossible to separate the symptoms produced by the endocarditis from those produced by the rheumatism. When a recurrent attack of endocarditis takes place in a case of old heart disease, where there is mitral regurgitation and a bruit present, it is rarely possible to make a definite diagnosis.

When the endocarditis is of the malignant or 'ulcerative' variety, the constitutional symptoms are usually much more marked, and are those of septicaemia engrafted on to heart disease. It may supervene in a subject already suffering from rheumatic heart disease, post-scarlatinal nephritis, or pemphig. In some cases the symptoms are very like those of acute tuberculosis, and in one case which came under our notice a death certificate to that effect was given, a subsequent post-mortem showing the real nature of the disease to be acute endocarditis. In such cases the bruit may be of a ruminal character and accompanied by a thrill; the aortic valves may also be affected and be the seat of a bruit. There is usually precordial pain, often

pain in the left shoulder: a hectic temperature rising to 102° or 104° in the evening and falling in the morning, and enlargement and often tenderness of the spleen. The urine is usually albuminous, often highly so. There may be joint pain and some of the phenomena of embolism. In one of our own cases there was aneurism due to embolism of the middle cerebral artery; in another embolism of the lenticular striate artery.

In any case of undoubted heart disease with intermittent pyrexia, malignant endocarditis should be suspected, especially if there is enlargement of the spleen and albuminuria. The aortic, mitral, and pulmonary valves are often affected in malignant endocarditis; the fact that an aortic leak is heard in a case of acute cardiac disease may help us to decide in favour of



Fig. 15.—Acute Endocarditis of Heart Taken in a case of Cancer. (See Text Case of Cancer.)

malignant endocarditis. The following case of malignant endocarditis may be taken as an example:

Malignant Endocarditis—Embolism of Brain and Spleen.—Sarah E. C., aged 12 years. Mother had had rheumatic fever. Four children have died of wasting and emaciation. Last Christmas child had chills for three months and also diarrhoea. A month ago child complained of pain in limbs. She has a cough and is short of breath, but has been going to school up to a fortnight ago. Admitted August 20, 1891. *History*—Aged least six years, outside supple like, no teeth, normal systolic murmur at apex, does not replace the first sound; somewhat accentuated, no leak. Large, normal. *Examination of alveoli.* August 27.—Child has improved. There is a grayish as well as a systolic limit; slight pruritic skin. Temperature goes to 102° at night. September 5.—No pruritic eruption now; rough papule at the apex well conducted into aorta. Temperature up to 103° . At 7 P.M. last night child complained of pain in right arm and leg. At examination this morning shows complete hemiplegia, the right arm

and legs are paralyzed; there is also facial paralysis of the same side; knee jerk diminished; plantar reflex present; slight drooping of right eyelid; hemianesthesia of the same side. Child not convulsions; tongue protruded to right; speech indistinct and thick; no erection; loss of memory for words; she will give the names of common objects; no optic atrophy; pupils much enlarged, no reflexes. November 24.—Patient has been getting weaker since last visit and increasingly, her face becoming quite pallid. Temperature has varied from 99° to 101°; the paralysis is exactly the same, except that contractions has become more marked during the last few weeks, and the knee jerk more pronounced. Early on the morning of November 24 she became unconscious, the breathing moribund; she lingered a few hours in this state and then died. *Post-mortem*.—Lungs.—Both lungs matted with grey infarcts, hypostatic pneumonia at bases of both lungs. *Aorta*.—Mark enlarged, extending from aortic to aortic; some two ounces of fluid in the pericardium; no pericarditis. Left ventricle dilated and containing much dark clot; mitral valve covered with large warty granulations which can be readily detached; posterior surface of left auricle is the seat of numerous granulations; there is also a small patch on the surface of the ventricle, where there has been friction or where a flap of the mitral valve has impinged. All other valves are normal. *Liver*.—Congested, swollen, and much enlarged. *Kidneys*.—Right kidney contains an effusion of some fluid; left also effused. Very large, contain two large infarcts. *Brain*.—Brain appears firm and healthy. There is no embolus at the junction of middle and anterior cerebral arteries on the right side; there has evidently been occlusion of one of the branches of the middle cerebral of the left side in the Sylvian fissure, as it is white and apparently plugged. Making horizontal sections through the brain, the first section shows some surface softening of the left ascending parietal convolution. Section made through the end of the lateral ventricle shows softening of the convolutions of the strand of Hall and caudate nucleus. Section through internal capsule shows a patch of softening involving the lentiform-artery artery, which is plugged with clot and impervious. The softest part is of a rusty colour. The thrombosis was no doubt due to an embolus in the left brachio-cephalic artery, and the softening on the surface to embolus of branch of left middle cerebral (see fig. 90).

There are other cases of acute endocarditis, however, which end in recovery at any rate for a time. We have seen several cases where there had been pyrexia of an intermittent type for many months gradually improved, and finally the temperature has become normal, and they have been able to get about and appear quite well, but have doubtless had damaged mitral valves.

Chronic Heart Disease

The immediate result of endocarditis is to cause a swelling and roughness of the endocardium which prevents the complete closure of the valves and thus allows of regurgitation (see fig. 55); puckering and thickening of the valves takes place as time goes on, especially if there are recurrent attacks, and the valves become permanently damaged. In children it is the mitral which almost constantly suffers. In some chronic cases the valves become adherent at their edges, and thus stenosis is produced. Gradually other and compensatory changes take place; if the regurgitation occurs at the mitral orifice, the left ventricle gradually dilates and becomes hypertrophied. At first the compensatory changes which take place are sufficient to prevent the patient from feeling any inconvenience, and both he and his friends may be ignorant of the existence of valvular disease; but sooner or later dyspnoea on exertion and precordial pain are complained of, which direct attention to the heart. Such patients often suffer from bronchitis—a result of the constant congestion of the lungs which is present in mitral regurgitation. If a physical examination of the heart is made at this period, a bruit is detected,

heard loudest at the apex, but well conducted into the axilla and to the angle of the scapula; the click of the pulmonary valves is accentuated, while the aortic sounds are weak. The apex beat is diffused and situated outside the nipple line, the cardiac dullness is increased to the left and frequently also to the right, as the right ventricle is apt to be dilated on account of the congested state of the lungs. In some cases the heart becomes enormously enlarged, so that the area of cardiac dullness extends from nipple to nipple, and the apex beat occupies perhaps the fifth, sixth, and seventh spaces outside the nipple line, while the whole of the precordial region is bulged forward by the hypertrophied heart. Often the left bronchus is pressed upon and the lower lobe of the lung becomes collapsed. During the last stages, which may be short or prolonged intermittently for many months or even years, the liver becomes congested and enlarged, there is albuminuria from congested kidneys, while the belly, scrotum, and legs become dropsical. Attacks of dyspnoea with pain resembling angina pectoris are not uncommon towards the last. Such cases may be very chronic, and even repeated attacks accompanied by much orthopnoea, cardiac distress, bronchitis, and dropsy may be succeeded from and the patient once more be patched up. In such cases, however, probably no fresh endocarditis occurs, and the attack is due more to the engorged state of the lungs and a temporarily overworked heart, the latter recovering by rest in bed, and the symptoms disappearing as the bronchitis passes off. Should, however, pericarditis occur in a case of old-standing heart disease, the end is not far off, as the muscle becomes damaged and further work is imposed on an already burdened heart.

In order to illustrate the lesions most commonly found in chronic heart disease in children, we have analysed the results of forty-one *post-mortem* made at the Children's Hospital, Manchester, during the last few years, on patients who have been under the care of our colleague Dr. Hutton or one of ourselves. The youngest was three years and eight months at the time of death, and the oldest fourteen years. With one exception all died from the results of chronic heart disease, that is, the heart disease was primary, those cases dying with pericarditis or endocarditis accompanying septicaemia or other fatal disease being excluded. They may be divided into the following groups:

1. **Malignant 'ulcerative' endocarditis** with embolism in various organs. Pericarditis mostly absent. 5 CASES
2. **Acute pericarditis** occurring in a heart already more or less dilated from the effects of mitral disease, and perhaps old pericarditis. Recent endocarditis mostly slight, coincident with the pericarditis. 20 CASES
3. **Adherent pericardium.**—Former attacks of pericarditis which had given rise to thick leathery adhesions around the heart, and in connection with old mitral disease, had given rise to extensive dilatation and gradual heart failure. A small aorta usually present and dilated pulmonary artery; mostly bronchitis and hypostatic congestion of the lungs. 10 CASES

4. **Chronic valvular disease without pericarditis.**—

Mitral incompetency, dilatation of both ventricles,
bronchitis and hypostatic congestion of the lungs. . . . 6 cases

In the above fifty-one cases the pericardium had been affected thirty times; in the remaining eleven no inflammatory lesion of the pericardium had taken place, but clear fluid without lymph was present in several of these. In several cases of acute pericarditis the amount of fluid was excessive, amounting in one case in a girl of nine years to 25 oz., the heart with the distended pericardium measuring 6½ in. from right to left; in another the pericardium contained 34 oz. In other cases the cavity of the pericardium was obliterated by old adhesions forming a thick layer one-eighth to one-quarter inch thick, which had evidently played an important part in bringing about the final result.

The **mitral orifice** was affected in every case; in the malignant variety of endocarditis there were the usual luxuriant vegetations present, mostly extending along the posterior wall of the left auricle where the regurgitant stream of blood had impinged. In the slighter forms of endocarditis the lines of contact of the valves were simply roughened, having lost their shiny surface. In other cases there was evidence of old endocarditis, the edges of the flaps were thickened, the chordæ tendineæ were thick and short, and in one case several chordæ had ruptured. As a result of this and also of the dilatation of the ventricles, the mitral orifice was incompetent, the valves not meeting during systole, or if coming in contact the roughened surface allowing blood to regurgitate into the auricle. In only two cases was there any stenosis of the mitral orifice, mostly the orifice admitted two fingers side by side, or it was wider still. In one of the cases of stenosis the mitral orifice only admitted one finger, the boy had not had rheumatism; he died of tubercular pericarditis and peritonitis (see case, p. 334). In the other case the patient was a boy of thirteen, who had been in the hospital five times with chorea, and finally with chronic lung trouble. At the *post-mortem* there were cavitation and small cretæ in the lungs, no definite tubercle anywhere, a puckered and funnel-shaped mitral orifice, and recent and old endocarditis of the tricuspid valves.

The **aortic valves** were affected in twenty, that is, in about half the cases, but the lesions were of a far less advanced or serious nature than in the case of the mitral. In most of the cases the valves were competent, and in no case had regurgitation apparently occurred to any great extent. Six times the note was made, 'The aorta only admits the little finger'; this was due not to the effects of valvular disease but to overgrowth in the aorta, which has already been referred to.

The **tricuspid valves** were affected thirteen times, or in about one-third of the cases, either by recent or old endocarditis. Probably the tricuspid valves were incompetent in the majority of cases in consequence of the dilatation of the right ventricle. The note often occurs that the tricuspid orifice was abnormally wide, and on one occasion it admitted four fingers side by side.

The **pulmonary valves** in two cases had slight regurgitation in them along the lines of contact. In most cases the pulmonary artery was dilated from the effects of back pressure.

The **murmurs** heard during auscultation in the case of children are in some ways more puzzling than those heard in adults. This is due in part to the more rapid action of the heart, and this is especially the case in trying to time a murmur present in the case of congenital heart disease in an infant. In chronic heart disease in children the hearts are larger and occupy more space in the chest as compared with adults. Evocardial sounds are controversial in children, and may be mistaken for murmurs.

In acute febrile diseases like scarlet fever or influenza, a murmurish first sound may often be heard, and inasmuch as endocarditis does at times occur in these diseases, we may at times be in doubt as to whether the abnormal sound is due to endocarditis or not. In these cases even an experienced ear may be deceived and an endocarditis is suspected, when the sequel proves this to have been a mistake. The bruit may disappear as the pulse and temperature fall. Certainly, murmurish first sounds are heard during scarlet fever, which disappear during convalescence; but on the other hand, an endocarditis occurring during scarlet fever is apt to be overlooked. In acute rheumatism or diphtheria a slight endocarditis may be overlooked, inasmuch as it may not give rise to a murmur, the tiny coverings along the line of contact of the valves being too minute to allow of regurgitation, and it is only perhaps after some weeks, perhaps during convalescence, that the murmur is heard.

Regurgitation through a damaged mitral valve gives rise to a murmur accompanying or replacing the first sound at the apex. *Post-mortem* evidence shows that if heart disease exists, there is regurgitation through the mitral orifice or damage to the mitral valve in practically all the cases, though other valves, as also the pericardium, may share in the damage. In the vast majority of cases there is regurgitation and no stenosis. In a considerable proportion of cases of chronic heart disease in children, especially where there is a dilatation of the cavities, there is a **double or triple murmur** at the apex, there being either a presystolic or a diastolic in addition to the mitral systolic. The presystolic is generally heard as a 'churring' or 'rustling' sound preceding the systolic bruit and running up to it. Is the presystolic under these circumstances diagnostic of a contracted mitral? The results of our *post mortem* lead us to support this view. In the two cases in which a contracted mitral was found *post mortem* there was no bruit at all heard during life in one, and a systolic bruit in the other. In the cases in which a presystolic and systolic was heard, there was no stenosis found *post mortem*, but in one case ruptured chordæ, and in others thickened and puckered valves. No bruit is more perplexing than the so-called **diastolic mitral**. This apex diastolic is common enough in the later stages of chronic heart disease when there is much dilatation. In some cases there is a hanging or intensified second sound at the apex, produced presumably at the pulmonary orifice, and perhaps the diastolic bruit may be what Dr. G. Steell has called 'the murmur of high pressure in the pulmonary artery,' which is well conducted to the apex. It can hardly be produced at the aortic orifice, as in some cases where it has been heard the aortic valves were normal and could not have allowed of regurgitation. We have noted this murmur in cases in which the pericardium was adherent, and in cases in which it was normal. On several occasions we have noted

the presence of a diastolic bruit, and on a later occasion have described it as being pericardic, and this has been confirmed by others.

Murmurs produced at the tricuspid orifice are best heard at the tip of the sternum, probably they are often masked by the presence of a loud mitral murmur. A double bruit at the base indicating stenosis and regurgitation at the aortic orifice is not common in children, though a systolic bruit is common enough. Often the mitral systolic is so well conducted to the base that a doubt may be raised as to whether there is aortic stenosis or not. In some cases in which a double bruit has been best heard over the pulmonary area, we have found *post-mortem* disease of the aortic valves, while the pulmonary have been healthy.

Dilatation of the cavities of the heart takes place in children apart from valvular disease, under two circumstances—an excess of blood pressure, as in acute nephritis, the force acting from within and bulging the heart walls as it were; and a chronic pericarditis, with adherent pericardium interfering with the systole, and so tending to dilatation; perhaps this may be aided by a degeneration of the cardiac walls. Acute dilatation of all the cavities rapidly takes place in some cases of acute nephritis following scarlet fever; the apex beat becomes diffused, and is seen outside the nipple line; in a few cases there is a bruit, due to the imperfect closure of the mitral valves, and symptoms of cardiac failure, and perhaps sudden death may take place. Dilatation of the left ventricle may occur in anaemia. Dilatation due to chronic pericarditis is a cause of chronic rather than acute heart disease; a pure case of this is rare, as endocarditis mostly occurs also; but sometimes cases may be found in which the heart is enlarged and the cavities dilated, with a thick pericardial attachment outside; the valves are normal or perhaps more or less thickened, and have evidently been incompetent during life. We have noticed signs of dilated heart with a muffled first sound in growing delicate boys towards puberty, especially if they are given to violent exercises.

Acute Myocarditis.—Acute myocarditis is not a common affection at any time of life, and much difficulty exists in stating what it consists in, as any general acute process affecting the heart must quickly bring a fatal issue. Changes in the cardiac muscles of a coarse description do occasionally occur. In rare cases children have been attacked with an acute illness with fever and delirium, and at the *post-mortem* an unsuspected abscess has been found in the muscle of the heart; such cases are probably septicæmic, as also are those where minute abscesses are found. Acute myocarditis appears also to occur in diphtheria; there is a general dilatation of the heart, more or less local pain, and dyspnoea followed by a fatal issue, changes being found in the muscular fibres of the heart, the muscular fibres being discoloured with fine granules of fat obscuring the striæ. It is well known, however, that sudden death may occur in diphtheria from paralysis of the respiratory muscles, as well as from disturbed innervation of the heart, so caution is required in coming to a conclusion that a myocarditis exists. Steffen has described a form of local myocarditis occurring in the course of typhoid, accompanied by symptoms of cardiac failure during life. Such cases must be rare. Myocarditis or a degeneration of the cardiac muscle may accompany both pericarditis and endocarditis. Steffen has also recorded cases of myocarditis with dilatation in some cases of purpura.

Prognosis.—The prognosis is usually favourable in pericarditis if it occurs in a hitherto healthy heart: the rub gradually disappears from adhesion taking place. We have, however, known sudden cardiac syncope to occur early in the course of a first attack of pericarditis. There is, of course, the danger of an endocarditis occurring at a future time, and also the danger of the injurious effects of an adherent pericardium. Pericarditis occurring in a heart which is hypertrophied from old-standing valvular disease is an exceedingly dangerous and fatal affection, and generally marks the beginning of the end. Death may be sudden at the first. In endocarditis occurring in the course of abscission there is, of course, great danger that permanent damage may be inflicted on the valves and the patient be handicapped for life. On the other hand, there is abundant evidence to show that bruis due to endocarditis, occurring either in connection with chorea or rheumatism, may disappear, and there is no reason why the endocardium may not return to its normal condition without crippling the valves: there is, however, the constant fear of a fresh attack at the old spot. The prognosis in malignant endocarditis is entirely unfavourable, though cases which apparently belong to this category occasionally recover. In chronic heart disease the amount of hypertrophy and dilation present may be taken as an index of the damage the heart has suffered. The prognosis in dilated hearts secondary to nephritis is favourable if the nephritis subsides and no valvular disease remains.

Treatment.—The treatment of pericarditis and that of endocarditis have so much in common that they may be taken together. It is needless to insist that the child should be put to bed and religiously kept quiet, all exertion and excitement being jealously guarded against. Too much stress cannot be laid upon the importance of this, and of maintaining rest as long as after the acute symptoms have passed away. To keep the heart as quiet as possible, and to impose the lightest work on it, during and after the attack, are points of the highest moment. The diet given must be suited to the rheumatic state; if peri-endocarditis is associated with it, milk and fluids will form the principal part. Of the local treatment during the acute stage, applications which soothe are better than counter-irritants. Ext. of belladonna mixed with glycerine may be spread on lint or flannel and applied to the precordial region, and covered with a layer of cotton wool, or sponge-pile lying out of hot water and sprinkled with iodazene may be applied. If there is much pain, a light mustard plaster (one in four or six) kept on for some hours so as to soften the skin will usually relieve. Lin. acetic and lin. acid, equal parts, may be painted over the precordial region. Local blood-letting by applying one or two leeches over the sternum is often useful in appropriate cases. Dr. D. B. Lees has highly extolled the effects of an ice bag applied to the pericardial region. We have seen cases where this method has been useful, but some patients rebel against it. Of medicines, salicylate of soda, with lig. arsenic. acet. if the inflammatory lesion is dependent on the rheumatic state, may be prescribed, ipec. digitalis being substituted and given in 3 to 5 minims doses every four hours if there is much dyspnea or sign of cardiac failure. Small doses of opiate are usually required, and are often of the greatest use in relieving pain and quieting the heart's action. Half to two grains of Dover's powder may be given at night.

and repeated once or twice in the twenty-four hours, according to circumstances.

In pericardial effusion, if extensive, tapping of the pericardium may have to be resorted to, to relieve the pressure on the heart. Before this is done as accurate a diagnosis as possible must be made, to ascertain how much the symptoms present, dyspnoea, orthopnoea, and cyanosis, are due to pressure of fluid, and how much to a dilated or hypertrophied heart; as many, perhaps most, of the cases of children with which we have to deal are in reality cases of pericarditis superimposed on chronic heart disease. In the latter case, if there is much cardiac dilatation and comparatively little fluid, paracentesis cannot relieve to any extent, and the cardiac walls may be wounded, though, if a *Jac* exploring needle be used, no great damage can be done.¹ The spot selected for paracentesis is usually the fourth or fifth interspace, halfway between the left nipple line and the left edge of the sternum, but care should be used to ascertain the position of the apex beat as nearly as possible. Having by the cautious use of an exploring syringe with a fine needle ascertained the presence of fluid a trochar and cannula may be used to draw it off, care being taken to withdraw the trochar as soon as the cannula is well inside the cavity of the sac. As a matter of fact paracentesis pericardii is rarely of much use, though it may postpone the fatal result a few hours, and bring temporary relief.

In chronic pericardial effusion the insertion of blue ointment or counter-irritation by drying blisters may be tried. In chronic purulent effusion, aspiration should be first tried; if this fails to prevent reaccumulation, incision and drainage by an india-rubber tube should be resorted to; this is occasionally successful, as in the case recorded by Dr. S. West. Symptoms of cardiac failure should be treated by digitalis, ammonia, ether, or alcohol. Ether may be injected subcutaneously or a few drops may be inhaled. The treatment of malignant or ulcerative endocarditis is unsatisfactory, and no drugs appear to influence its course. The most likely to be useful are quinine, digitalis, and the alcho-carbates. The treatment of congenital or chronic heart disease must be directed to saving the heart all unnecessary work and to strengthening it as much as possible. Children with chronic heart disease need to be guarded most carefully against the effects of cold, as bronchitis is easily contracted in such, and a little bronchitis adds materially to the work of the heart, which is, perhaps, at best labouring under great mechanical disadvantages. The parents and friends of such children must be cautioned against allowing the child to over-exert itself; it is no uncommon thing for such a child to go for a while to the seaside or convalescent home and come back worse, for the simple reason that it has been on its legs all day, enjoying the novelty of its newly found pleasures.

¹ On one occasion we tapped the pericardium with an exploring syringe armed with a large sharp-pointed hollow needle, and withdrew some two ounces of serum; this was followed by pure blood. After the needle was withdrawn the child became rapidly worse, and died in a few minutes. The post-mortem showed the pericardium full of blood, and a punctured wound through the right ventricular wall close to the interventricular septum. The wall was very thin at this spot and almost flaccid. Had a trochar and cannula been used, the trochar being withdrawn on entering the pericardium, the accident could not have happened. The needle had entered the pericardial sac in the first instance, and then, moved the right ventricle.

whereas a moderate amount only of exercise, insufficient to overwork the heart, would have secured an improvement. All active exercise should be forbidden, rough games, riding 'cycles,' and gymnastics. The medicines of most use to control and regulate the cardiac contractions are digitalis, belladonna, iron, and strychnine. Digitalis is of the greatest value, but must not be too continuously given; any intermittency in the beat should be the signal for its cessation. When dropsy sets in, digitalis with diuretics like iodide of potassium, acetate of potash, and squills will be required. In excessive dropsy Seeley's carboles may be used with advantage.

Mediastino-pericarditis, Pleuro-pericarditis

An inflammation of the serous membrane which is reflected over the anterior edges of the lungs and surrounds the pericardium sometimes takes place, mostly in association with a more general pleurisy or with pericarditis. At times the pleurisy appears to be local, being confined to the serous membrane covering the pericardium and lung adjoining it. The symptoms of such an inflammation are necessarily indefinite, almost the only definite sign being a pleural pericardial friction sound—that is, a rubbing sound which is synchronous with the cardiac beats, and which is more intense during inspiration as the lung expands and its edge passes in front of the heart. The rub now disappears entirely during expiration. The deeper the inspiration the more intense the friction sound becomes. As a result the edge of the lung becomes adherent to the pericardium, the space between the two becoming obliterated. In some cases a tubercle or chronic inflammatory process goes on in the mediastinum, involving the serous membranes, connective tissue, and perhaps the mediastinal glands, so that a matting of all the parts takes place, the edges of the lungs, pericardium, and great vessels being firmly bound together. The pericardium may be adherent to the walls of the heart, there may be extensive pleuritic adhesions of one or both lungs, and the adhesions in some cases are tough and firm and of almost cartilaginous hardness.

The etiology of these cases is uncertain. Most cases are associated with chronic tuberculosis of the lung or with cancerous mediastinal glands; in others no evidence of tubercle can be found, a simple chronic inflammation of the connective tissue going on, ending in cirrhosis. The immediate result of this process is to hamper the action of the heart, preventing its complete systole, to interfere with the filling of the lungs during inspiration, and to compress the large veins entering the chest. The liver becomes constantly engorged, the hepatic system of veins dilated, and a secondary cirrhosis results.

Symptoms.—The course of this curious affection is very chronic. In well-marked cases the symptoms are those which are likely to be caused by an obstruction to the flow of blood into the chest. Dyspnoea on exertion, cyanosis of the face, chilling of the fingers, distention of the veins of the neck, chest, and abdomen during inspiration; and, later, oedema of the face, arms, feet, and abdomen. There may be signs of pulmonary tuberculosis. The 'pulsus paradoxus'—i.e. the pulse becoming smaller during inspiration—may be present, but certainly it is absent in some cases. In other cases the most marked symptom is anæmia, with an enlarged liver, suggesting a

primary syphilis of the liver; such cases are exceedingly chronic, and they improve if the fluid in the abdomen is removed by tapping, and will go on for months or even years; gradually the portal obstruction becomes greater and the patient dies of exhaustion.*

The following case may be taken as an example of this affection, running an acute course:

Mediastino-pericarditis.—*Adult.*—John E., aged 4 years. Admitted September 9, 1891. Mother states that her first five children are dead. No history of syphilis; patient had convulsions at six months of age. Last May he had a cough and was attended by a doctor. A month later his abdomen began to swell, and soon after his feet; this has gradually increased. On admission his face is puffy, the abdomen is distended with fluid, his legs are much swollen. Temperature 101° , pulse 120, respiration 40. *Lungs.*—There is some diminished resonance over the right upper lobe in front, over both lungs there are fine bubbling rales. *Heart.*—Apex beat is third interspace inside nipple. Abdomen is greatly distended, dullness in both flanks and in epigastrium, third gland felt. *Liver.*—Edge not much felt, spleen cannot be felt. September 10.—Temperature 101° , pulse from 90 to 120. Crapulation is hung on both sides. September 12, child evidently dying; abdomen relaxed; edge of liver, both right and left lobe, felt below umbilicus; a nodule about the size of a marble felt in the left lobe. Temperature 105° — 106° before death. *Post-mortem.*—*Lungs* not adherent; right lower lobe somewhat pneumonia; upper lobe of left solid with grained granules, but no abscess. Much yellow fluid in abdomen and some lymph on liver, spleen, diaphragm, and great omentum. *Heart* not enlarged; pericardium thick and whitened, but can be peeled off, leaving a granular surface adherent to the diaphragm. In the middle and posterior mediastinum there are enlarged glands and fibrous tissue. The glands are much enlarged and containing case of fibrin, several with pus-like contents. *Abdomen.*—*Lymph* and tubercle between liver and diaphragm, some lymph on surface of liver. *Liver* much enlarged and granular, one lobe size of a marble on anterior surface of right lobe near broad ligament, creases show cut, surface mottled appearance. *Spleen* enlarged, distended with blood. *Kidneys* pale.

Raynaud's Disease—Paroxysmal Hemoglobinuria

About one-fourth of the cases of Raynaud's disease reported occurred in children under ten years of age (J. E. Morgan). Concerning the etiology of this disease nothing is known; in some cases there is a history of malaria, but certainly in many of the reported cases there was no such connection. In some cases hemoglobinuria has been a prominent symptom, and it is believed by some (Dickenson, Abercrombie) that paroxysmal hemoglobinuria is a part of the more general disorder which may or may not be present.

The first symptoms of Raynaud's disease may appear as early as the end of the second year, the friends noticing that the child's hands or feet after exposure to cold become numb and blue; the ears and cheeks may become easily affected. Before an attack comes on, there is shivering and perhaps crying with pain or discomfort. In more severe cases the hands and feet are swollen and of a dark blue colour. In some of the cases after the attack is over the child passes urine containing albumen and hemoglobin (J. Abercrombie). In other cases no abnormal urine is noted. The exciting cause of the attack in all these cases is exposure to cold; the attacks are commoner in the winter, and when occurring in the summer the attacks follow a cold.

* See 'Mediastino-pericarditis in Children,' by H. R. Hutton, *St. Thomas's Hospital Reports*, vol. xix., and also 'Exhaustive Mediastino-pericarditis,' by T. Hearn, *Medical Circular*, November 25th 1891.

bath or a chill of some sort. In mild cases the attack does not last long; if warmth is applied the blueness and numbness passes off in the course of half an hour or less.

While such is the common type of attack in Raynaud's disease, it happens at times that the numbness or blueness of the extremities ends in gangrene and spontaneous amputation. A typical case of this kind is recorded by Harold (*Lancet*, February 14, 1895) of a weakly boy of four years of age; both hands and feet were affected. The hands and feet were blue and numb, the hands recovered, but the feet beginning at the toes became gangrenous, and a spontaneous amputation of both feet gradually occurred. The boy eventually made a good recovery. In these cases there is no doubt a stenosis or narrowing of the arteries to the limbs or the capillary arteries are affected. All children who are liable to these attacks obviously require the greatest care in the avoidance of cold, and possibly during cold weather have to be confined to bed, or at any rate in a room. The treatment is the treatment of symptoms.

CHAPTER XV

DISEASES OF THE CIRCULATORY SYSTEM—continued

NAEVUS.—Nævus is perhaps the commonest congenital disfigurement met with in children;¹ usually it is nothing more than a blemish, though occasionally it becomes more serious, either from danger to life or serious interference with its subject's welfare. Nævi are probably always congenital, though not always noticed at birth, since they may not be large enough to be conspicuous until some time later.

Nævi belong to the class of the angiomas, and are defined as 'tumours consisting of newly formed blood vessels,' though it is obvious that they are not always tumours in the sense of there being any definite mass of tissue—e.g. 'port-wine stains'; still this is merely a question of a diffuse as contrasted with a circumscribed growth.

These growths may be classified as—

I. (a) *Simple angioma*, telangiectasis, congenital naevus, mother's mark or port-wine stain. The vessels composing the new formation are identical in structure with normal arteries, veins and capillaries. (b) *Cavernous angioma*, lacunar or erectile angioma. The blood circulates in a lacunar system as in normal erectile tissue. (Cornil and Ranvier.)

II. Nævi may be considered as (1) arterial, (2) venous, (3) capillary, (4) lacunar, blood-vascular growths.

III. Or, considered from their locality, the nævi may be divided into (1) cutaneous: (a) a mere staining or port-wine mark, (b) a distinct mass with larger vessels. (2) Subcutaneous. (3) Mixed—i.e. both cutaneous and subcutaneous. The different forms of nævi are readily distinguishable.

Stellate Nævus.—The so-called 'stellate' or 'spider' nævus, which is doubtfully a new formation, and very probably only a dilatation of pre-existing vessels, resembles in appearance the *vena stellata* on the surface of the kidney of a carnivore. It is most common in the face, disappears on pressure, and is closely allied to the mere weather marks of those exposed to wind and cold; it is sometimes seen about the faces of children.

Port-wine mark consists of a diffuse stain, varying much in size, form, position, and colour; usually there are no obvious dilated vessels, though these can be made out on more minute examination. These marks occur, perhaps,

¹ Dupuy is quoted by Cornil and Ranvier as saying that one-third of the children born at the Clinic of the Faculty of Medicine in Paris have nævi, and these usually disappear spontaneously during the first few months of life.

most commonly on the face, often on the hands, and occasionally elsewhere; they may cover very large surfaces, such as the whole side of the face. There is no elevation of the growth above the level of the skin, only the superficial layers of which are involved, and pressure completely attenuates the stain for the time.

Cutaneous Nevus.—The common cutaneous nevus is usually small, not covering more than a square inch of surface at most; it is somewhat raised above the level of the surrounding skin; the individual vessels can often be distinctly made out, though not always; the colour of the growth is usually vivid red, and on pressure the colour and much of the swelling disappears, but a slight thickening remains and the skin is 'granular.' These

growths lie in the corium, and are usually sharply defined, but are encapsulated.

Subcutaneous Nevus.—The growth lies entirely beneath the corium, and forms a distinct tumour; the skin over it is natural in colour, or only shows a faint bluish tint; the swelling does not entirely disappear on pressure, and is often encapsulated more or less perfectly.¹

Mixed Nevus.—This is a commoner form than the last; it has the characteristics of the cutaneous and subcutaneous varieties combined—i.e. there is a subcutaneous nevus with a cutaneous patch on its surface; corium and subcutaneous tissue are both involved. It is seldom that the cutaneous part is as extensive as the subcutaneous, and in this and the last form there is often some cavernous formation.

After removal from the body and escape of its blood, a subcutaneous or mixed nevus consists of a tough, spongy, or stringy mass, often somewhat lobulated, and always much smaller than might be expected from its size before removal. If encapsulated, it will be found that only a small number of vessels, and those of considerable size, feed the growth and enter it at various parts—a very important fact as regards the treatment of these cases.

Simple Nevus consist of newly formed vessels having the structure of capillaries, and presenting ampullar or sacoid dilatations; the vessels are supported by a framework of connective tissue, and often fat.

Cavernous Nevus consist of an irregular network of globose tissue, including freely intercommunicating spaces like the channels in a sponge; there

¹ See J. Paget.

² A good account of the structure of nevi will be found in Cressell and Kerner's *Histology*, to which we are indebted for part of our description.



Fig. 15.—Kæmmerer. "Elevated Nevus of the Face, involving the lower lip and both cheeks up to the ear."

is occasionally unstriated muscular fibre developed in the septa, as well as vessels and nerves. The endothelium lining a naevoid lacuna is exactly like that of a vein. These naevi are formed by dilatation of newly developed capillaries and subsequent absorption of their barrier walls, so that true openings are made between adjacent vessels.

Importance of Naevi.—Usually naevi are simply disfigurements; sometimes, however, they may give rise to serious bleeding from rupture of vessels by injury or ulceration, as in a case of our own where the soft palate and uvula were the seat of a large naevoid growth and frequent bleeding occurred; similar trouble has been met with in the case of rectal naevi. Internal naevi may possibly be dangerous from hæmorrhage, or from extravasation of blood setting up peritonitis, &c.; but this must be very rare. Some very extensive naevi are of importance from interference with the action of the muscles or the growth of bones, or from producing myoidly hypertrophy of skin. We have seen fracture of the thigh due to weakening of the femur from an extensive naevus growth in the limb.¹ Unusually overgrowth of limbs may occur also from the presence of naevi; and in the case figured (fig. 17) the man was unable to obtain work on account of his disfigurement. We have seen a case of pyæmia having its origin in a suppurating naevus, and another where pyæmia followed puncture and partial removal of a naevoid growth.

Danger occurring to Naevi.

Naevi sometimes grow rapidly from the first and spread over considerable areas; in many cases, however, they grow very slowly, alternately grow and remain stationary, or disappear altogether, the last result being especially common in the cutaneous form. As Mr. Holmes and others have pointed out, and as we ourselves have seen, as thins, especially apparently whooping cough, often seems to bring about the cure of a naevus; possibly the straining in coughing may produce extravasation and thrombosis in the naevus, and so obliteration.

Naevi undergo spontaneous cure by thromb change, the vessels becoming obliterated and shrinking into fibrous cords. Such result may follow treatment, or accidental irritation by friction of the clothes, or pressure in lying, and so on. In other instances calcareous degeneration or thrombosis takes place. Cystic change in naevi is very common; the cysts contain serum,



Fig. 17.—Naevus of the face in a man of 50. The growth was usually but slowly increasing. The whole skin of that side of the face was deep crimson, the lip and tongue were involved, and the lower jaw distorted and curled by the weight of the enormous lower lip. The man died of acute pyæmia. The specimen is in the Owens College Museum.

¹ The patient was under the care of our colleague, Mr. T. Jones.

more or less deeply coloured, and arise from the shutting off of a lacunar space or dilated vessel from the blood stream; the cystic is often combined with the fibrous and fatty degeneration.

Suppuration and absorption of a naevus is an important condition; for, on the one hand, it may produce a cure by obliteration of the vessels, or, on the other hand, as already pointed out, septic absorption or bleeding may result; happily obliteration is the common termination. Various combinations of these changes may be found going on in a naevus at the same time; pigmentary changes are also found, and sometimes an overgrowth of hair, especially in the lipomatous form (vide p. 356). Mere pigmentary maculae are sometimes called naevi, but it is better to restrict the name to the vascular growth.

Sites of Naevi.—Naevi may be found almost anywhere over the body, but there are certain markedly favourite positions. External naevi are most common on the head, and of all places we should say the most frequent is over the anterior forehead; the lips, cheeks, eyelids, or any part of the face may be involved. The trunk and limbs are less commonly affected than the face, but perhaps this is partly to be accounted for by the latter being less anxious about naevi on the body; the labia are not uncommonly affected. We have seen a case in which most alarming growth of the naevus took place during pregnancy; subsidence of the swelling followed delivery. Different forms of naevi often occur in the same patient—e.g. a port-wine mark on the face or hand and a mixed naevus on the scalp. Naevi occurring inside the mouth, in the cheeks, tongue, or inner surface of the lip, more rarely in the palate, are of course more serious than external ones; they are also much less common.

Visceral naevi are often seen on the liver, and less often on the kidneys, spleen, and other organs; the muscles and bones are also sometimes affected. It is common to see naevi on the skin of mesentericoles both cerebral and spinal—a fact noticed by Mr. Holmes, and one of some importance from a diagnostic point of view.

Several cases of rectal naevi are on record, among others one mentioned by Mr. Barker which caused death by hæmorrhage.¹ We have met with a case which exactly simulated piles, and was cured by ligature. The extent of tissue involved is sometimes very great, as already stated; thus we have seen the whole lower extremity naevoid, and Mr. Barker has recorded a case of the whole upper extremity being so affected.² (vide also fig. 37).

Treatment of Naevi.—It should be a rule of practice not to interfere with naevi unless they are growing or have been stationary for some time, since, as already pointed out, very many disappear of themselves. The important points to consider for each naevus are whether it is cutaneous, subcutaneous, or mixed, and what is its relation to important adjacent structures, which may be endangered by treatment or by the resulting scar. It is unnecessary to mention all the methods proposed for treating these growths; only the most efficient will be described here. Soften naevi may readily be cured by puncturing the centre of the star with a hot needle. Port-wine marks require careful consideration as to whether the resulting white scar will not

¹ *Brit. Med. Jour.* 1883.

² *Clin. Soc. Trans.* 1884.

be as disfiguring as the red mark, and it must be remembered that in cases where a large surface is involved a long course of treatment is required to remove the mark.

Linear scarification, multiple puncture, the actual cautery or a caustic, such as fuming nitric acid, and in some cases electrolysis, will succeed. From five to twenty or more coils of a Stohrer's or Weiss' battery should be used. If large, the patch should be treated in sections, so as not to have too large a sore surface at once.

Cutaneous nævi are best treated with the actual cautery; if small, a heated needle is sufficient; in larger growths Paquelin's cautery is the most useful instrument. Narrow lines may be scored across and across the nævus, or multiple punctures employed; after using the cautery once, as soon as the wound is healed, it will often be found that little patches remain unobliterated: these should be watched for some weeks before reapplying the cautery, as they often shrink subsequently without further operation. The cautery should be at a dull red heat, and should be applied deeply enough to reach through the nævus. Ethylate of sodium is fairly efficient, but usually requires several applications, and is not, we think, better than the cautery; it has the advantage of not requiring the use of an anæsthetic, though it is followed by a good deal of temporary smarting. For port-wine stains the ethylate may be applied every two or three days according to the effect produced, and then, if required, fresh applications may be made after two or three weeks. Vaccination on a nævus is not a good plan. For subcutaneous or mixed nævi we cannot recommend injections of any kind; they are often efficient, but always dangerous, extensive thrombosis or embolism, causing immediate death, having followed their use: if they are employed, a temporary ligature should be put round the nævus and removed a few minutes after injection. Ligation of nævi is uncertain, as well as tedious and troublesome. We think treatment by excision, by multiple puncture with the cautery, and in suitable cases by electrolysis, is the most generally useful.

Excision is applicable to well-encapsulated growths of small or moderate size, not involving important structures. There are certain essential points in the operation: first, the incision must be carried well wide of the growth and not within its capsule; there will then be only a few well-defined vessels to secure, and not a freely bleeding cavernous tissue, as is the case if the growth is cut into; next, the skin in a mixed nævus, if the cutaneous part is very small, should be removed as far as it is involved, provided always the edges of the wound can afterwards be brought together easily so as to obtain primary union. If the skin is widely involved, it should not be taken away, but, as suggested by Mr. Teale, dissected off the nævus and preserved; this, however, necessitates opening up the næviform tissue, and complicates the operation; sometimes also the cutaneous nævus continues to grow afterwards.

A bloodless method of excising nævi is that of passing long needles or keel-pins beneath the base of the growth crosswise, then winding an elastic thread round the needles and excising the growth after dissecting back skin flaps; the needles are then withdrawn and the vessels are secured. There is no bleeding until the elastic is removed.¹ Degenerated nævi should nearly always be excised if they are treated at all; in some instances, where

¹ A plan devised, we believe, by Mr. Dumas Colley.

there is cystic degeneration, a seton passed through the cyst causes it to shrink; but there is a certain amount of danger in this plan if any part of the nerve remains undegenerated.

The little galvano-caustic apparatus devised by Mr. Golding Bird for encapsulating lymphatic glands we have used with good effect for large nasal nevi not removable by excision.

In using the actual cautery the fine or middle-sized point of the Paquelin's cautery is entered through the skin and made to traverse the nerve in several directions from one point; if the nerve is large this is repeated at another

spot, and so on; a little vasoline is then applied to the cauterized surface and the effect is watched; after all contraction has ceased another portion is, if necessary, attacked, until the whole mass has shrunk.

Pressure is occasionally successful as a means of treating nevi, but is chiefly applicable to cases where other treatment is impracticable, as in very extensive nevi of a limb; it may be employed successfully sometimes in nevi of the scalp, when the underlying skull forms a firm basis; especially if combined with subcutaneous breaking up of the nevus with a tenotome. In cases of distortion of nose, and in some severe cutaneous forms, scraping away the growth with a sharp spoon will sometimes do good.

Importance of Navi in special Localities.

Navi occurring in certain localities have more than ordinary importance, either from the difficulty of their treatment or diagnosis or from the risk attaching to them. Navi of the lip is often found involving the whole thickness of either lip, and is usually either of the mixed or subcutaneous variety; the surface is somewhat prone to ulceration in the moist form from constant irritation, and the growth is often very unsightly. If degenerated and cystic, or if there are large cavernous spaces in the nevus, it may be mistaken for a labial mucous cyst or for lymphatic malformation. Puncture from the mucous aspect with the Paquelin's cautery is usually the best mode of treatment, but in some cases it is a good plan to excise a segment of the lip and bring the edges together as after a harelip operation. Orbital nevi are usually associated with similar growths upon the face; they may cause exophthalmos and ectropion; the nevusoid character of the



Fig. 36.—Orbital Nevus. The growth extended deeply causing exophthalmos and ectropion, and spread upwards upon the forehead.

¹ A good case of the effects of pressure under such circumstances is recorded by Hodge, *Lancet*, May 1881.

growth is indicated by the spongy feeling and the possibility in some cases of pushing back the protruding eyeball and so emptying the growth of blood. Treatment by electrolysis is the only serviceable method in these cases.

Nævus of the tongue may give rise to macroglossia and cause protrusion of the organ, or may be limited to a small part of its surface; it is liable to be mistaken for lymphatic macroglossia or for a mucous cyst. The colour will usually serve to distinguish it from the former, though the two conditions seem to be sometimes combined, and the compressibility of a nævus will mark it off from the latter affection; in doubtful cases a grooved needle will clear up the difficulty. The actual cautery, or in rare cases excision, of a part of the tongue is the treatment required. In one child we excised the anterior third of the tongue by a Λ -shaped incision, and brought the sides of the wedge together with sutures; the result was good and repair was rapid. A similar condition may be met with on the gums or inner surface of the cheeks. Sometimes large blood lacunæ are met with beneath the tongue, looking like varicæ; the soft palate and uvula are also occasionally affected; in one instance where both conditions existed the sublingual nævus was cured by the actual cautery, and the uvula removed by the galvanic écarteur; the patient was attacked by pyæmia, but ultimately recovered completely.

Nævus of the eyelids must be treated with great caution to prevent any subsequent distortion; it is best usually to attack small portions at a time with the actual cautery and wait until cicatrization is complete before a second application. The same rule applies to nævus of the nose where too vigorous treatment may produce an unsightly, sharp-pointed, beak-like appearance if the skin is too much destroyed. In some instances excision is the better plan.

Nævi around the orbit are sometimes very difficult to diagnose, especially if they are degenerated, and consequently have lost their colour; dermoid cysts, meningocæles, simple serous congenital cysts, and fatty growths should be borne in mind as sources of fallacy. In one instance (fig. 56) there was a cyst with none of the appearance of a nævus; on tapping it, altered blood escaped, and on incision it was found that the growth was localized and in part solid (i.e. degenerated). A seton was passed through it at last after failure of incision and drainage, excision being out of the question, and the mass separated freely, but unfortunately erysipelas occurred and the child died. At the *post-mortem* the orbit and cavernous sinus were found full of more or less degenerated arterial tissue; the nævus spaces soon mostly fall off blood, and minute abscesses were seen with the microscope in sections of the growth.

Speaking generally, most nævi can be recognised by the presence of the remains of some superficial arterial tissue, by the possibility of reducing the size of the growth by pressure—this point must not, of course, be allowed to mislead in swellings about the head or spine—and by the peculiar spongy



FIG. 56. Arteriovenous nævus.

feeling. This sensation is sometimes to be felt in a growth where solid masses are also perceptible. The fact that the tumour is congenital or has been noticed in very early life, and occasionally the presence of extravasation of blood in the skin, as well as, of course, the results of tapping, will usually clear up a doubt.

Certain rare forms of vascular deformity are occasionally met with in children. In a case of our own the condition may be best described as



Fig. 50.—Nasal Lipomatosis. The partly pigmented pedunculated masses were composed of fat and degenerated nervous tissue, and the whole surface was thickly covered with hair. As usual in these cases, the child was blind.

pendulous hairy mass, closely resembling the so-called 'pachydermatous,' was excised with a good result.

Lymphaticæ Nævi.—Lymphatic nævi are much rarer than blood nævi, but many of the so-called congenital cystic growths should be classed as

¹ A full report of the case here alluded to will be found in the *Annals of the Children's Hospital for 1882-83*. Vide also T. Smith, *ibid.* Nov. 1882.

² Hyde of Chicago has recorded a very similar case in the *Lancet*, August 1885.

arterio-venous varic, all the vessels being dilated and peduncle; the facial, orbital, and intracranial vessels were involved as well as some of the cerebral sinuses, the straight sinus being converted into a pouch as large as a thrush's egg and its walls calcified (fig. 51).

Arterio-lymphaticæ is also occasionally met with in children, and sometimes ligation of a main vessel, such as the carotid, may be required, as also in some cases of arterial varic. St. Germain relates three cases of circled arterio-lymphaticæ cured by the use of chloride of zinc ankers. (*Hyde's Chicago for Enfants*, 1884.)

Nævus lipomatodes is the term applied to a form of degenerated nævus in which there is much development of fatty tissue forming masses which often hang in pendulous folds; there is commonly pigmentation and hairy overgrowth. The condition is rare, and appears to be associated with idiosyncrasy, as in the typical case under our care, from which fig. 50 was taken. No treatment is called for in such a case. We have recently (1887) seen a female infant a few weeks old with an almost exactly similar condition. Occasionally, however, where merely a local mass is found, it should be removed by excision. This was the treatment adopted for the child shown in fig. 51, where the

cytic lymphangiomata. Instances of this condition are seen, as shown by Vinchow, in macroglossia, described at p. 167.

Hypoma and one form of so-called 'giant foot' are similar conditions; fig. 61. Sometimes in giant foot the cutaneous lymphatics are clearly visible as transparent, dilated, tortuous vessels opening in the skin; the part is greatly enlarged, and spongy on pressure. The disease is a rare one, and probably pressure or cavity puncture would be the most successful mode of treatment. Treves has recorded a case in which ulceration had occurred, and quotes Bony that congenital giant foot is commoner in females, and most frequent in the right leg; the temperature of the part may or may not be raised. Ulcers, if they occur, readily heal.

Occasionally in macroglossia, as in a case of ours, the superficial lymphatics form minute transparent cysts on the surface of the tongue; here



Fig. 60.—Deposited Nerve of Scaly.



Fig. 61.—Lymphatic Nerve of the Foot. The side of the foot was seen, and in the affected area the extremities of the toes can just be made out, embedded in the mass of nerve tissue. Dilated and opaque lymphatics were visible in the skin.

removal of part of the tongue might possibly be required to prevent suffocation, since these growths are liable to rapid increase in size. A large tumour of the thigh, of congenital origin, that we removed a short time ago from a child of 2½ years, was made up of spongy tissue exactly like a sarcoma, but the spaces were filled with lymph instead of blood; other similar cases have been recorded. (Vide also chapter on Tumours.) Hoggan has described multiple lymphatic naevi of the skin, a condition believed commonly to accompany blood naevi, and to be much more frequent than is supposed; these growths are not conspicuous by their colour, and are therefore commonly overlooked; they are of little clinical importance, unless probably in an early stage of elephantiasis. We have also met with instances of these naevi.¹ Cases of

¹ Hoggan, *Ann. of Anat. and Phys.* April 1884. *Lancet*, 1888, vol. 2, p. 691.

probably congenital lymphatic varices of the limbs have been described by R. W. Parker; he thinks they have a tendency to become locally inflamed.¹ We have recently met with a case of lymph varix of the conjunctiva and supra-ocular region, causing an unsightly deformity; the varix varied much in size, and sometimes 'puffed up' and became painful.²

Large multilocular cystic swellings may be met with in the neck, resembling in external appearance the hygromata which are associated with lymphatic macroglossia, but differing from these lymphatic tumours in that some of the cysts are found filled with blood either coagulated or more or less altered, and become 'laky.' In the same swelling cysts may contain fluid clear or only tinged with blood. It is difficult in such cases to be sure whether the growth is a blood varix which has undergone cystic degeneration, or a lymph varix into which hæmorrhages have taken place. Such a case which we saw with Dr. McNicoll, of Southport, occurred in a child of seven weeks old; and as it was growing and threatened to cause dyspnoea, it was treated by laying open and partly removing the larger cysts. The operation, though extensive and formidable for so young a child, had a satisfactory result.

Aneurism in children is extremely rare; only a few cases have been recorded, and these appear all to have been either traumatic or the result of embolism, the embolism giving rise to softening of the arterial coat, and consequent formation of the aneurism. A paper on this subject by R. W. Parker in the '*British Medical Journal*,' 1864, may be consulted. We have only met with one case of aneurism, in a child aged seven years, who was suffering from idiopathic endocarditis; the aneurism, which was situated on the left middle cerebral artery, was no doubt due to an embolus; it finally ruptured and gave rise to extensive meningeal hæmorrhage. Dr. A. Jacoby has reported several cases of aneurism in children, due to arteriosclerotic degeneration, one case of the descending aorta in a girl of seven years. Sarré has reported five cases, one in a fetus, and three in children of two, ten, and thirteen years respectively.

¹ First chap. on Tumour Growth in Childhood.

² The case, with a drawing, has been published by Dr. Miles in *Trans. Ophthalm. Cong., Heidelberg*, 1881. For an account of various rare abnormalities of the blood and lymph vascular systems (also *Nervous Anæmia*, &c.) the reader is referred to Fawcett and Kelsch's monograph on *Idiosyncrasies*.

CHAPTER XVI

DISEASES OF THE BLOOD AND BLOOD-MAKING ORGANS

Anæmia

CHILDREN of all ages are liable to suffer from anæmia, from causes both known and unknown. Some children are habitually pallid, without, perhaps, being in any way out of health; and this peculiarity seems to run in families. In the majority of cases anæmia means ill health, the process of blood being due to one or other of a great variety of ailments. It is unnecessary for us to describe the anæmia which is due to obvious causes, such as tuberculous, heart disease, syphilis, malaria, or the anæmia which is the result of some acute disease. We will chiefly confine our remarks to certain forms in which the anæmia is often profound and the pathology by no means certain. A slight acquaintance with the forms of anæmia from which children suffer will be sufficient to convince anyone that there are different forms of diverse groups. Thus we have anæmia accompanied by great enlargement of the spleen, and an anæmia in which no such enlargement is present. We have the so-called Pernicious Anæmia, which appears always to go on to a fatal issue. In some cases there is a tendency to purpura, and while in all forms of anæmia hæmorrhages are common when the anæmia becomes extreme, yet in some cases purpura is an early symptom, and makes its appearance without the anæmia being very great. The groups into which we divide these cases are selected rather for convenience of description than from their actually forming independent or 'self-standing forms' of disease.

It is unnecessary to say that an examination of the blood gives important information with regard to the nature of the anæmia, and is therefore of use as regards prognosis and treatment. For the details of the methods of this examination we must refer the reader to the various clinical manuals.¹

The examination includes (1) The estimation of the amount of hæmoglobin present as measured by Föcisch's hæmometer. In healthy children there may be 85 to 95 per cent., in profound anæmia as little as 30 to 35 per cent. (Föcisch).

(2) Counting the number of the red and white corpuscles, by means of the Thoma-Zewa apparatus. In round numbers in healthy children there are five million red corpuscles to the cubic centimetre; in some forms of anæmia the number may sink to two millions. The number of white corpuscles varies from 3 to 9,000 (Limbach) in children, to 12 to 13,000 (Gumbel) in infants under a year.

(3) A microscopical examination of the red corpuscles to determine their shape, size, and colour. In extreme forms of anæmia there may be some

¹ Or see Karmark *The Blood Changes in Disease Conditions*, Medical Clinician, July, August, October 1914.

nucleated red corpuscles present, and the corpuscles may be trihedral and very pale.

(4) A film of dried blood is stained with eosin and methyl blue in order to distinguish between the varieties of white corpuscles present, and to determine their relative proportion. Following Ehrlich's method, Kamphak distinguishes the following varieties:

(a) **Lymphocytes**, consisting of small cells with a large blue nucleus and narrow zone of clear protoplasm; they are supposed to derive their origin from lymphatic gland tissue. (b) **Large mononuclear cells**, consisting of cells with a large oval or indented nucleus, and a large zone of surrounding clear protoplasm. They are supposed to be derived from the marrow of bone and spleen. (c) **Finely granular or polymuclear (neutrophile) cells**. The nucleus is multipartite, and lobed. The protoplasm is filled with granules which stain with eosin. The number of these cells is increased in febrile conditions; they are in normal conditions in adults the most numerous of the white corpuscles present. (d) **Coarsely granular eosinophile cells**; they have a single round or horseshoe nucleus, the protoplasm has coarse granules which stain strongly with eosin.

As regards the relative numbers of these in the blood of healthy adults and infants, the following numbers may be taken as approximately true. Lymphocytes, adults 20 per cent., infants under one year 50 per cent.

Large mononuclear cells, adults 5 per cent., infants 6 per cent.

Finely granular neutrophile cells, adults 75 per cent., infants 51 per cent.

Coarsely granular eosinophile cells, adults 2 per cent., infants 3 per cent. (Udoff, Gamolin).

From this it would appear that in early life the lymphocytes are increased at the expense of the finely granular or neutrophile cells.

Anæmia with Œdema.—In all cases in which the anæmia is great there is a tendency to the accumulation of serum in the serous cavities, and a liability to subcutaneous œdema. In the out-patient department of hospital practice it is common to meet with infants or children under two years of age who are anæmic, and at the same time œdematous, the back of their hands and feet readily pitting. Such cases are often looked upon as suffering from nephritis, but the urine is mostly free from albumen and casts. There is usually no enlargement of the spleen. These cases are commonly seen in the anæmic children who have suffered from acute diarrhoea or some other exhausting disease which has given rise to great anæmia. The anæmia is due to the great drain on the system during acute or long-continued disease, or possibly it may be the result of the action of toxic albumens or peptones absorbed into the blood from the alimentary canal. We must also remember that the arterial pressure in young children is normally very small, and easily reduced by acute disease. (See Nephritis.)

Simple Anæmia Chlorosis.—There is a class of case mostly occurring in older children which resembles the chlorosis of adults. There is no enlargement of the spleen, no purpura or any evidence of organic disease. The children are markedly bloodless, languid, and easily get out of breath; rattles may be heard in the base of the heart, and in the veins and arteries of the neck. Both girls and boys may be affected in this way about puberty. In one instance coming under our notice, two brothers and a sister, aged 13, 7, and 5½ years, suffered in this way; their mother was also anæmic. They

were intensely anæmic, and were *flowy* and *lithargic*. They were fairly well nourished as far as fat was concerned; there was no splenic enlargement, no albumen in the urine, and no hæmorrhages. In all three there was an irregular pyrexia, a rise of a degree or two taking place most evenings. An examination of the blood showed a diminution of red blood corpuscles, and no striking excess of white corpuscles. They all three improved considerably during their stay in hospital. It is well to bear in mind that such cases are exceedingly apt to suffer from tubercle.

Idiopathic or Pernicious Anæmia is apt to occur in children; out of 102 cases published by Dr. Pys Smith in the *Gay's Hospital 'Reports'* for 1882 there were six between the ages of seven and fifteen years. It has been met with in children of all ages. Kjellberg has recorded a case in a boy of five years, Elben in a girl of three years, and W. Steffen in a girl of sixteen months. It is always fatal.

No cause can usually be assigned for the anæmia; in one case coming under our notice the child had been much neglected and badly fed. Schapiro reports a case of a girl of 15 years who was supposed to suffer from pernicious anæmia, but began to improve after passing a tape-worm—*Bothriocéphalus latæ*.

The symptoms and course are exactly the same in children as in adults. The first symptoms are those of weakness, breathlessness, and pallor, coming on without cause. The anæmia becomes extreme, the skin is blanché and of an earthy tinge; the conjunctivæ and mucous membrane of the mouth are pallid, and the muscles weak and flabby. Usually there is no great loss of flesh. Vomiting is not uncommonly a marked symptom. In some cases there appears to be a slight rise of temperature at night, 100° or 102° ; in this respect pernicious anæmia resembles other forms of anæmia. Purpuric spots are sometimes present on the skin, and retinal hæmorrhages and optic neuritis may take place (S. Markens).

An examination of the blood in an advanced case shows a very marked diminution of the red blood corpuscles without any leucocytosis, indeed the white corpuscles are usually diminished, and a considerable number of large red corpuscles (megakaryoblasts) are present. In a case of pernicious anæmia which, as we have already remarked, is an exceedingly fatal disease, diagnosis is of great importance. It is most likely to be mistaken for some form of secondary anæmia, in which there has been severe hæmorrhage, or the feeding has been bad as in scurvy. The following are the chief points to be noted in examining the blood. See Karthaus (*loc. cit.*).

Children	Secondary Anæmia	Pernicious Anæmia
Red blood corpuscles slightly reduced in number; <i>RD</i> considerably reduced.	Red blood corpuscles reduced; marked decrease of <i>RD</i> .	Red blood corpuscles greatly reduced; <i>RD</i> diminished, but not in proportion.
Red corpuscles retain their size and shape, nucleated red corpuscles rare.	Nucleated red corpuscles present; red corpuscles vary in size and shape.	Nucleated red corpuscles extremely common; they are easily injured.
No leucocytosis.	In acute cases there is leucocytosis due to an increase in the number of the polymorphous leucocytes.	No leucocytosis, usually a diminution.
No large red corpuscles present.	No large red corpuscles.	Large red corpuscles are present.

The course is often acute, usually varying from one month to three months.

Mixed Anatomy.—All the organs are in a bloodless condition, the muscles are in a state of fatty degeneration, and minute hæmorrhages are found on the surfaces of the organs. There is no further alteration found in the spleen or other viscera.

The following case illustrates many of the above points :

Previous History.—Walter H., aged 11½ years, has been getting pale and weak for six months, no vomit known; has had hallow cough and frontal headache; for two months has had frequent epistaxis, and for some time has had living flies, and spots "like bruisés" have appeared on thighs and shins; no bleeding from lungs or bowels noticed. Mother strong, father said to have been phthisical in early life; brothers and sisters all healthy and strong, but of them now in hospital with scarlet fever; all recovering. Admitted August 20. Large, well-formed, well-nourished, and muscular boy, dark brown hair and eyes, height 4 ft. 7 in., intelligent, intensely anæmic, tongue lined pale and brown, fauces pale, tonsils large; respiration 32, fairly deep; pulse 140, regular and full; temperature 101°; both lungs dull, with weak respiratory sounds, no crepitation, heart's area normal, negative heaving and valvular area second to fifth space, murmur at left base murmurous, spleen and liver not felt in abdomen, blood watery and pale (no corpuscles), generally normal in shape and form characteristic anæmic, a few are elongated; white corpuscles only slightly increased relatively, very much in size, most of them being smaller than usual; urine dark, pale, no albumen, no excess of urates or phosphates; colored serum of iron. August 25.—Temperature now between normal and 101°; September 5.—Temperature still below 100°; respiration 30; pulse 140; no cough or night sweating, has attacks of syncope on attempting to sit up, has vomited twice today, no cardiac murmur. Died September 7.

Post-mortem.—Forty hours after death body well nourished, intensely anæmic, eye mucous membrane, a few corpuscles of serum in each conjunctival artery, patches of erythema along margins of lungs, no consolidation, abundant sub-pericardial effusions; about 2 in. clear serum in pericardium; no pericarditis; no endocarditis, abundant sub-pericardial cothyrus, mixed under adventa three fingers, muscular fibres pale; much "solidified" moulting of endocardium. Spleen 3½ in., soft and flabby; liver 3½ in., very anæmic; kidneys 4 in., very soft, intensely anæmic, capsules just off easily.

Hagiusky records a case of pernicious anæmia in a child of 3½ years. It suffered from hæmophilia for a year before its death. When seen it was very pale, the liver and spleen were enlarged. An examination of the blood showed only 2,500,000 red blood corpuscles per ccm., and only 17 percent Hb (Fleischl). The proportion of white corpuscles to red 1 in 100. The red blood corpuscles had undergone change of shape; there were megaloblasts and nucleated red corpuscles, many large anisocytar cells, and a small number of the multi-nuclear. No eosinophile cells.

Treatment.—The medicines most likely to be of service are iron and arsenic. Phosphorus and cod liver oil have been tried with some success; murex and raw meat juice should be given. In the majority of cases the progress is from bad to worse.

Scurvy.—A scorbutic state may sometimes be met with in children as the result of bad or improper food, especially if fresh vegetables have been excluded from it; such are cases of true scurvy, similar in every respect to those which used to occur so frequently among seamen. A similar condition is met with in association with certain depressing diseases such as tuberculosis. At other times when it occurs it is difficult to assign any cause.

The patient is usually anemic, though he may be well nourished as far as subcutaneous fat is concerned; the gums are spongy and offensive, they bleed with the slightest injury, the teeth are loose and may fall out; hemorrhage is apt to occur from the nose, kidneys, and bowels; purpuric spots are common, and bruising occurs after the slightest injuries. The majority of the cases which come under our notice in hospital quickly improve with proper dieting and careful nursing. In one of our cases, where a scorbutic condition was present in a boy of ten years in association with fibroid phthisis, improvement took place on several occasions when we had him in hospital, but he eventually died from exhaustion, the result of frequent hemorrhages. At the *post-mortem* a chronic tuberculosis was found, but nothing was found to explain the hemorrhagic condition suffered from during life. A scorbutic condition is not infrequently associated with rickets in young children. (See Rickets.)

Treatment.—In all cases where there is anemia, with spongy gums and a tendency to hemorrhages, lemon or orange juice should be given, and fresh vegetables in some form or other should enter into the diet. Scraped mutton, beef juice, and eggs should be given. The gums should be carefully cleansed, and painted with glycerine of tannin, borax and tincture of myrrh, or some other astringent. Iron and cod liver oil should be given internally. Hemostatics, such as *ex. hamamelis* liq., gallic acid, and turpentine, will often be required.

Enlarged Spleen

The spleen is a very vascular organ, is functionally more active in childhood than in after life, and is more apt to become temporarily engorged and enlarged. The best method of determining the enlargement during early life is by palpation rather than by percussion, as the lesser rigidity of the abdominal walls during early childhood usually readily permits of this. Palpation of the spleen is effected by standing at the patient's right side and gently pressing two or three fingers of the right hand into the left hypochondrium beneath the costal arch, when the lower and inner edge of the spleen if it is enlarged can be readily felt as a movable tumour which can be pushed upwards. It can hardly be said that the spleen is abnormally enlarged unless its lower edge extends below the costal arch. Enlargement is very common during childhood, and accompanies various conditions. An enlarged spleen is most frequently associated with an anemic condition, though exactly what the relation between the two is is uncertain (see p. 362). An enlarged spleen is met with when the portal system is interfered with, as in cirrhosis of the liver. In two cases coming under our notice the spleens were greatly enlarged, and in these cases it is quite possible to overlook the cirrhosis of the liver and look upon the case as one in which the splenic enlargement is due to Hodgkin's disease or some anemic condition. It is enlarged in many cases of rickets and syphilis, though certainly not in all cases; it is chiefly so in those cases in which pallor and anemia are marked symptoms. It is enlarged and hard in ague, and also when hardacrenous and in association with leucocytosis and Hodgkin's disease. It is also enlarged in various acute diseases, such as typhoid fever, acute tuberculosis

and pyæmia, and in some other febrile states, such as ulcerative endocarditis.

Anæmia Splenica. Anæmia Infantum Pseudoleukæmica.—Is an ill-defined group of cases, occurring mostly in children under two years of age, the anæmia is often profound, and the spleen strikingly enlarged. Sometimes mothers will bring such children for treatment, as they have already noticed the large spleen as well as the paleness of the child. There is usually a history to be obtained of ill health, more especially of aggravated indigestion, or some acute illness, and nearly all of them exhibit evidence of rickety deformities. In a well-marked case, the anæmia strikes the observer at once as being much out of the common; the lips are a pale pink, and the face is white or of a slightly yellow tint; on placing the hand on the abdomen, the edge of the spleen is distinctly felt (it can sometimes be seen), and the tip can be traced downwards on a level with, or below, the umbilicus. There may be enlargement of the liver. The urine is free from albumen, and except quite at the termination of the case, there are no hæmorrhages and no icterus. There is often irregular and intermittent pyrexia. The course is essentially chronic; the patients usually improve slowly under treatment in hospital with careful diet and tonic medicines. They readily succumb to intercurrent diseases, such as measles or pneumonia. In the worst class of case the anæmia becomes more and more profound, they die exhausted; in the later stages there may be hæmorrhages, purpura, and icterus. On the other hand, we meet with 'borderland' cases, where there is a moderate degree of anæmia and splenic enlargements, with perhaps well-marked signs of rickets. The pathology of these cases is very obscure; an examination of the spleen *post mortem* shows it to be hypertrophied, firm, and hard, and on section it is of a dark purple colour; a microscopical examination shows nothing beyond hypertrophy. The etiology of these cases is no less uncertain. The condition closely resembles that seen in malaria, but in this country this can be excluded with certainty. In a certain proportion of the cases a history of syphilis can be obtained; in thirty cases reported by Carr¹ there was a history of syphilis in eight, a doubtful history in six, and in sixteen no history could be obtained. In sixty-three cases reported by Fox and Hall² in forty-one per cent. there was a history of syphilis to be obtained. The figures of the last observers surprise us; our experience has been that a definite history of syphilis is uncommon, and certainly in a large majority of our cases no history of syphilis could be obtained. It is true that syphilis produces both anæmia and enlargement of the spleen, especially during the acute phases; but we are not aware of any cases of syphilis having been under observation during the acute stage and having then passed into (while under observation) a condition of splenic anæmia. That there is a close connection between this condition and rickets is certain, as almost all such children exhibit evidence of rickety changes in the bones, and this anæmic state occurs almost exclusively during the first two years of life, when rickets is most common. We are inclined to agree with Carr in believing that, while both syphilis and rickets may play a rôle in producing this condition of splenic

¹ *Lancet*, April 25, 1880.

² *Brit. Med. Jour.*, April 1886.

anæmia, they are neither of them the sole or efficient cause, but that congenital weakness, chronic dyspepsia, bad feeding, and unsanitary conditions may interfere with the blood-making organs and lead to a condition of profuse anæmia.

Beck and Schlesinger¹ draw a distinction between *Anæmia deficiente piodoloblastica* and *Anæmia splénica*. The first rather awkward-sounding name was applied by Jakob to cases in which there was anæmia, enlarged spleen, and leucocytosis; the latter to a class of case in which there was anæmia, enlarged spleen, but no leucocytosis. How far this distinction can be maintained we are not prepared to say; but there is a strong probability, we think, that there may be different causes at work in producing anæmia with splenic enlargement in young children, and we are hardly in a position to accord to this class a position among the 'self-standing' diseases.

In three cases in which the blood was examined by Fehlebrand² in children (ages ten months to one and a quarter years), in which there was marked anæmia, enlarged spleen, with a comparatively small liver, no lymphatic enlargement, and well-marked signs of sickness, he found that the amount of hæmoglobin was as low as thirty to forty per cent., the number of red corpuscles about three million per cubic centimetre, the leucocytes forty to forty-five thousand, there were many nucleated red blood corpuscles, and some very large red ones (megablasts). The number of lymphocytes varied from 20 to 60 per cent. In one of our cases, a girl of fourteen months, our resident medical officer, Dr. H. Wainborough Jones, on examination of the blood found 2,800,000 red corpuscles and 112,000 white corpuscles per cu. mill. The hæmoglobin amounted to thirty per cent. There were some nucleated red corpuscles, and some megablasts and microcytes. No eosinophile cells were seen.

While in a vast majority of cases the children who suffer in this way are under two years of age, yet occasionally we meet with older children who are affected in a similar manner, as in the following fatal case:

Anæmia: Enlarged Spleen.—Thos. Arthur C., aged 4 years. Up to four months ago quite healthy; no serious illness. Has lived always in Manchester. Father and mother healthy. Four months ago had a fall, not confined to feet, abdomen painful and tender ever since, two months ago had severe epistaxis, with no known cause; very much blanched ever since, but sometimes vasidus; has had occasional pains and twittings in left arm for as long at a time, and slight twittings of the body also. On admission, December 20th, plump, with marked pallor, a few purple spots on thighs and feet; superficial glands generally enlarged, liver indurated, no oedema of feet; abdomen prominent in epigastrium and hypogastrium regions; liver and spleen much enlarged, heart and lungs nil. Urine none; no albumen. Temperature 101° F. 36. June 2.—Cold, toxicæmia over whole circulatory area, no mediastinal distress; heart's base increased, some beat felt outside nipple line. Blood thin and watery, with some increase of white corpuscles; spleen rather tender. Temperature irregular, 98° to 101° and 102°. June 13.—Constantly sweating; temperature still high and irregular. June 14.—Died 5 A.M., unconscious all night. Post-mortem.—Twelve hours after death: great pallor, some oedema of extremities; blood very fluid, liver uniformly enlarged, pale with few yellow points (hepatic vessels). No peritonitis, spleen 5 in. by 3 in.—smooth, firm, purple on surface,

¹ *Hæmatology in Studies*, Leipzig, 1892.

² *Archiv für Kinderheilkunde*, Heft. 1, u. 2, 1893.

Homöopathic glands very slightly enlarged: kidneys firm and very pale. No peritonitis, no ascites, no staining of organs with iodine. *Blood*.—Left ventricle hypertrophied, right ventricle dilated, subpericardial ecthymoses, valvular necrosis. Lungs emphysematous, with abundant ecthymoses on surface and in substance. No enlarged mediastinal glands, trachea firm, scarcely anastomotic, otherwise apparently healthy. No venous congestion, no fluid in cavities.

Treatment.—Iron, arsenic, and cod liver oil, especially the former, are the drugs most likely to be of service in anæmia, though the treatment must necessarily be modified according to the cause. The cachexia produced by syphilis must be treated by a combination of iron and mercury, quinine if malaria is suspected. Care must be taken to see that the bowels are acting normally.

Raw marrow of bone, raw meat juice, orange juice, peptonised milk should be given.

Hodgkin's Disease—Anæmia lymphatica.—This disease is characterised by an enlargement of various groups of lymphatic glands and also of the spleen: there is progressive anæmia, and more or less intermittent fever. According to Goswami's statistics, 16 out of every 100 cases occur in children under ten years of age. The earliest symptoms which calls attention to the disease is enlargement of some lymphatic glands, usually the cervical, though the axillary or mediastinal may be early affected.

The glands just behind, or in front of and beneath, the scroto-mastoid are frequently the first to be enlarged, or the group at the angle of the jaw: the glands at first are firm and movable, varying in size from time to time as if the vessels were gorged at one time and more empty at another. With the glandular enlargement there is usually a marked increase in size of the spleen, and the child becomes weak and pallid. A prominent feature of the disease is the occurrence of attacks of pyrexia: the temperature at times continues elevated for some days, or it may assume the intermittent type. Other groups of glands may become affected: there may be an extension into the mediastinum, and the glands may exert pressure on the trachea or large veins, so that there is oedema, cyanosis, or asphyxia. The axillary and inguinal glands may also become affected. In some cases the external lymphatic glands may be but little affected, but the mediastinal or retro-peritoneal glands and the spleen may be much enlarged. The course of the disease is very chronic, but the prognosis is unfavourable, and sooner or later the child dies exhausted. At the autopsy the spleen is found enlarged and infiltrated with an adenoid growth, while other organs, as the lungs, liver, and kidneys, are also infiltrated, only in less degree.

Diagnosis.—The diagnosis of Hodgkin's disease in an early stage is often extremely difficult when the patient is brought with a mass of enlarged glands in the neck or other part. If the glandular tumours vary in size from time to time, if there is intermittent pyrexia or enlarged spleen, Hodgkin's disease may be suspected. If the glands suppurate they are probably tubercular. We have frequently seen enlarged tubercular cervical and axillary glands mistaken for the enlarged glands of Hodgkin's disease. Possibly tubercular disease and Hodgkin's disease may co-exist.

Treatment.—Arsenic and phosphorus are the medicines most likely to be useful, but the disease generally progresses to a fatal termination.

Leukæmia.—Leukæmia is a rare disease during childhood, but the possibility of its being present should be borne in mind when a pallid child with a large spleen presents itself, especially if on examination of the blood there is marked leucocytosis. It occurs at all ages: babies at the breast have been affected, and also those more advanced in years; it cannot be said that anything certain is known about its etiology, though poor living, various depressing conditions, and malaria have been credited with producing it. The earliest symptom to call attention to the disease is abdominal distension, which is found to be due to a greatly enlarged spleen; with this there is dyspepsia, perhaps abdominal tenderness, and marked anemia. The disease is a chronic one, and the prognosis unfavorable. Like Hodgkin's disease, there may be enlargement of lymphatic glands and intermittent pyrexia. Later in the disease the anemia becomes profound, edema of the subcutaneous tissues takes place, and often there are hæmorrhages.

Two forms of leukæmia are distinguished, the mixed form in which the spleen and marrow of the bones are mostly involved, and the lymphatic variety in which the lymphatic glands are enlarged. An examination of the blood may solve the difficulty.

Karnbach gives the following diagnostic points to enable the two varieties to be distinguished from one another and also from Hodgkin's disease:

<i>Hodgkin's Disease</i>	<i>Splenomedullary Form</i>	<i>Lymphatic Leukæmia</i>
Red corpuscles slightly diminished.	Red corpuscles diminished.	Red corpuscles diminished.
Hb slightly diminished.	Hb diminished.	Hb diminished.
Slight changes in the red corpuscles.	Red corpuscles vary in size and shape, many nucleated.	Hardly nucleated red corpuscles.
Only moderate leucocytosis due to an increase of lymphocytes and perhaps neutrophils with.	Enormous leucocytosis, increase in large basine and eosinophile cells; small white number of lymphocytes.	Great increase of lymphocytes, other kinds diminished.

Treatment.—Atonic, phosphorus, cod liver oil and iron are the most likely drugs to be of use. Mercurial injections over spleen and glands may be tried.

The Hæmorrhagic Diathesis.

During early life a disposition to bleed arises under many different conditions. In some cases this disposition to bleed is hereditary, in others it is the result of many different forms of illness. We will consider the hereditary variety first.

Hæmophilia.—This term is applied to a disposition to bleeding which is hereditary; it affects males more often than females, but the females often appear to transmit this tendency to their sons. This tendency to bleed may only appear in one or two members of a family, the rest escaping, but those who thus escape may transmit the diathesis to their children. Hæmophilia does not usually appear at the time of birth, the disposition usually first manifesting itself after the end of the first year of life. It is true that newly born children are apt to bleed from the navel or suffer from hæmatæmesis,

but this is the result rather of some disease than from inherited tendency. Children who exhibit this diathesis seem to exhibit it in different degrees at different times; sometimes they appear to beise on the slightest injury, while at other times there is hardly any tendency in this direction. Purpura or "bruising" is the most common manifestation; slight pressure or a slight knock on a limb, such as might take place by the nurse catching a child, will suffice to bring out a well-marked bruise, which is many days in fading. Sometimes a number of hæmorrhagic spots make their appearance spontaneously, and in the same way extensive subcutaneous bleedings may take place. A slight scratch or cut may lose blood for some time before it stops, cracks or fissures in the skin of the lips may cure in the same way. Of the mucous membranes perhaps the gums most often bleed—friction with a tooth brush may be enough to start a hæmorrhage. Epistaxis is also very common, and may be very difficult to stop. There may be hæmorrhage from the stomach from straining when vomiting, or blood may appear in the stools.

Hæmorrhage also takes place at times. Hæmorrhages of the scalp are liable to follow slight falls, or injuries, and bleedings of considerable amount may take place in the muscles and other deeply situated structures. Bleedings may take place into the joints, especially the knees. It may be the result of injury, but in some cases this does not appear to be the case. The joints appear swollen and tender, and contain fluid—the fluid gradually disappears with rest; but if repeated bleedings occur much thickening of the synovial membrane with overstretching of the ligaments and nodular swellings, resulting in distortion and more or less permanent crippling of the joint may result. A joint into which hæmorrhage has once taken place is apparently likely to suffer again. We have seen patients lamed for life in this way.

We have also met with a case in which, in addition to hæmorrhage two joints on several occasions, bleeding took place beneath the palmar fascia, causing great pain, and a somewhat alarming appearance of the hand. The blood was, however, slowly absorbed, and no serious ill result followed. It occurred in the patient, of which the following notes were taken:

Hæmophilia. Effusion in Knee Joint.—A boy of 12, was first seen in September 1886, with Dr. Shattuck. There was no history of hæmophilia in the family. At Christmas 1886, he sprained his left knee, and it at once filled with blood, and has not been well for any length of time since. The left leg is smaller than the right, and it will be hard always to be so. When seen in September the left knee was enormously distended with fluid blood, and was a good deal hotter than the other. His brother, who was seen at the same time, had numerous bruises, and one which contained fluid blood, which was becoming absorbed and giving rise to inflammation of the adjoining parts. On examining the knee thirteen days later it much resembled a joint the subject of chronic rheumatoid arthritis; there was thickening of bone and cracking of the joint, with occasional "locking." The limb could not be fully extended, and there was a inch thickening. In April this he was seen again; the knee was again swollen after an injury, though not to the extent of the former attack.

Perhaps the most serious complication of all is a cerebral hæmorrhage. This may be the result of a blow or a knock, or it may apparently occur spontaneously. Thus a girl of 3½ years, who had had from time to time bruise marks on her skin, suddenly developed symptoms of paralysis of the respiratory muscles, and she died asphyxiated in three or four days. At the

post-mortem a hæmorrhage into the medulla was found. (See case under Medullary Hæmorrhage, p. 460.)

The prognosis in all these cases of hæmophilia is necessarily uncertain. They are carried off in many cases by concurrent disease, to which they fall an easy prey, or as the result of some accident. It is certain that some reach adult life, as examples of this condition are not uncommon among adults.

The diagnosis is not difficult in a well-marked case, but there may often be a doubt as to whether the disease is hereditary or whether it has supervened on some form of disease, but in the hereditary form the history of bloodiness in the family will necessarily be of help.

Very little is known for certain about the pathology of these cases. It has been supposed that there is some congenital affection of the arteries or the capillary vessels, which allows the blood to easily ooze through their walls, but this has not been substantiated. We must be content for the present to confess our ignorance.

No children require so much care or are greater causes for anxiety than lateral bleeders. No operation, however slight, can be permitted in these cases. Gum-lancing, removal of tonsils, drawing teeth, opening abscesses, must be avoided. They must be carefully watched and guarded in every relation of life. When bleeding is going on turpentine, iodoine, ergot, and gallic acid are the most likely drugs to be of service. Tr. fern percliar. may be applied locally. When bleeding has taken place into a joint, the child should be kept in bed with the affected joint fixed in a splint and cooling lotions applied. After a week of rest, if no recurrence of the bleeding takes place, very gentle movement and rubbing should be employed to prevent stiffness and favour absorption of the blood as perfectly as possible. All violent exertions must be avoided by these children; they are, in consequence, a source of constant anxiety to their friends.

Purpura simplex, Purpura hæmorrhagica.—These terms are applied to conditions in which the hæmorrhagic diathesis has been acquired, that is, is not hereditary. The name *P. simplex* is applied when the bleeding is subcutaneous only, that of *P. hæmorrhagica* when the bleeding takes place from various sources besides the skin, such as kidneys, &c.

Purpura hæmorrhagica occurs under a number of different conditions. Thus it occurs (1) in malignant smallpox and measles, in typhus, occasionally in scarlet fever, in acute ileo-colitis, and especially in diphtheria; in these cases it is no doubt due to the presence of albumoses in the blood; (2) in various anæmic conditions, especially towards the later stages, when the anæmia is severe, such as scorvy, pernicious anæmia, Hodgkin's disease, rickets and syphilis; (3) we have it following attacks of gastric catarrh, diarrhoea, croupous pneumonia, whooping cough, in diphtheria and also in meningitis.

It occurs at times without being associated, as far as can be made out, with other diseases; but it may be doubted if it is ever an independent disease. In most cases, at any rate, some other disease precedes it, and it seems rather to occur as the result of changes effected in the blood by the pre-existing disease.

Purpura sometimes makes its appearance as a mild affection, at other times it is acute and quickly fatal. Thus a child may present itself with

large and extensive ecchymoses on the limbs or trunk, but it is not in the least ill, and the subcutaneous bleedings disappear in a few weeks or less. He perhaps a child is seized in the midst of apparent health with ecchymoses and severe hæmorrhages from the kidneys or from the alimentary canal; there is delirium, and then coma and death in a few days. Sometimes purpura accompanies a type of disease which resembles scurvy more than anything else, and yet there has been no deprivation of fresh food or hardship of any sort. As an example of this we may relate the following case:

Purpura Hæmorrhagica.—GUY F., aged 6 years. Was always a lively healthy boy till August 1886, when he had a severe attack of diarrhoea, with collapse, at the middle. He never completely recovered himself, being pale and weak. At the end of the following January he suffered from bloody stools, occasional vomiting of dark blood, and frequent bed-sores on his body. He continued weak in the same state for the next month, when (February 11) he tripped and fell, striking his head against the edge of a table. A hematoma of the scalp quickly formed on the right side of his forehead; during the same night the fingers of the left hand twitched continuously, and the grasp on that side was feeble. Next day the grasp of left hand was very weak, and there was some difficulty in flexion and extension of the wrist. Four weeks after the accident the hematoma and swelling had nearly disappeared, and power had nearly returned in the left hand. He, however, continued to go downhill; there was pain in the stomach and frequent vomiting, issuing of blood from the nose, and purpuric spots appearing on the trunk and limbs. A loud, rough breath was heard over the whole chest area, he became more and more anæmic, and there was marked wasting. He was unconscious for 20 hours before death, which occurred at the end of March. *Post-mortem*.—Erosion of clots found in the ventricles; punctiform bleedings on surface of heart and lungs; no valvular lesions; sounds of heart pale, left ventricle dilated. Stomach much dilated, walls of stomach and also of intestines very thin; spleen enlarged and soft. Extensive subcutaneous hæmorrhage over surface of the brain; some pad found between dura and arachnoid. On the right ascending frontal convolution is a hæmorrhagic, crescent in shape, involving the width of the convolution, extending an inch into brain substance. The bleeding had involved the hard men-

The ecchymoses which occur vary much in size and number; in rare cases the greater part of an arm or thigh is of a dark purple colour from hæmorrhage beneath the cutis. In other cases the purpuric patches vary in size from mere points like hæmorrhagic flea bites thickly scattered over the skin to patches the size of the palm of one's hand. In erythema nodosum the nodes, which are first of a rosy tint, become in a day or two purple from capillary hæmorrhage. In rare cases patches of subcutaneous hæmorrhage become gangrenous; Sangster has recorded such a case. A girl of 3 years had several purpuric patches on the extremities and chest; one of these on the arm ended in gangrene, recovery eventually taking place. Steffen has collected several more cases, in which multiple skin gangrene occurred after purpura; the cases proved fatal.

In a number of cases hæmorrhage occurs either on the surface or into the substance of the brain. We have already referred to two such cases coming under our notice, one in which there was meningeal hæmorrhage, and the other in which a small bleeding occurred in the Rolandic area. Gross (loc. cit.) records a case where there was a hæmorrhage the size of a nut in the substance of the right lobe of the cerebellum, and also beneath the pia mater. Steffen has collected four fatal cases in which meningeal hæmorrhage or hæmorrhage into the brain substance was found *post mortem*. In some cases

† See Gross, *Ueber Purpura im Kindesalter*, *Archiv für Kinderheilk.* (Hift.) u. 11, 1894.

there has been evidence of brain hæmorrhage, in which recovery has taken place. Hæmorrhage has also been found in the substance of the spinal cord.

Steffen reports cases in which a myocarditis occurred in the course of purpura, leading to dilatation of the left ventricle; and a consequent inefficiency of the mitral valves. In such cases a mitral murmur will be heard during life. (See cases, p. 370.) Hæmatemesis is not uncommon. Indeed, vomiting is frequent, the vomited matter being streaked with blood, probably from punctiform bleedings taking place in the stomach. Blood in the stools also occurs in these cases, and punctiform bleedings are frequently found post mortem. Hæmatæria is a frequent symptom; in some cases there is albuminuria and no blood present.

The association of purpura with rheumatism is an interesting one. Schöten gave the name of *Pelliosis rheumatica* to a form of purpura in which the joints were affected. Probably Steffen is right in altogether dropping the name, inasmuch as the so-called *Pelliosis rheumatica* is purpura in which there has been bleeding into the joints or the muscles or tissues around the joints. In true rheumatism purpura does occasionally occur, and as is well known Erythema nodosum occurs in association with rheumatism.

As a rule an attack of purpura is feverless, but in some cases there is moderate fever, especially before the appearance of a crop of petechiæ. In the some cases, such as have been described by Heron, Pye-Smith, and others, in which there is vomiting hæmatemesis, hæmatæria, petechiæ, delirium and coma, there may be a high temperature.

An examination of the blood during an attack shows a diminution of the hæmoglobin and of the red corpuscles. The leucocytes may at first be in slight excess, but they also diminish in number. Micro-organisms have been found, but as yet bacteriology has shed but little light on the pathology of this disease. Experimentally, it has been shown that the presence of peptides and albumoses in the blood give rise to hæmorrhages and many of the symptoms of purpura.

Concerning the prognosis in purpura little can be said. Purpuric smallpox is well-nigh always fatal, and purpura occurring during the course of diphtheria is an extremely bad omen. In malignant scarlet fever and also in malignant measles the rash is at times said to be purpuric. We have never seen such cases, but on several occasions we have seen the rash in both diseases assume a purpuric appearance, and recovery take place without a bad symptom. In some forms of anæmia with wasting, the appearance of purpura marks the beginning of the end. Purpura simplex is always of less grave import than those cases in which hæmorrhages occur from internal organs.

The treatment of purpura is the treatment of hæmorrhage generally. Among the most valuable hæmostatics are turpentine (℞v-ss), ex. hæmæstetis liq. (℞v-℞ss), ex. ergotæ liq. (℞v-℞xx), ergotine by subcutaneous injection, gallic acid (gr. v-gr. x), and acetate of lead (gr. j-gr. i).

Diseases of the Retro-peritoneal Glands.—There are a considerable number of lymphatic glands situated behind the peritoneum, at the back of the abdomen and in the pelvis. They are most numerous lying along the

vena cava inferior and aorta and their branches. These glands may become enlarged and caseous in tubercular disease, or may be the starting point of a lymphadenoma or abscess. When caseous, they are so in association with malignant disease; in one case under our care the caseous glands surrounding the vena cava completely compressed the latter, giving rise to oedema of the lower limbs and enlarged veins on the surface of the abdomen. In another case a lymphadenomatous tumour exactly simulating an enlarged spleen, which had commenced in some retro-peritoneal glands, was first noted in the left hypochondriac region. It grew to an enormous size, occupying nearly half the abdomen. Some of the more obscure forms of abdominal and pelvic abscesses appear to originate in these glands.

CHAPTER XVII

TUBERCULOSIS

In speaking of chronic tuberculosis of the lungs we have explained the fact that, in children far more commonly than in adults, the tubercular lesions not only affect the lungs, but are widely distributed through the body (see p. 240). It is this general distribution of tubercle which often renders the diagnosis difficult during life, as the physical signs of the disease in the lungs are less obvious than where, as in the adult, the tuberculosis begins at the apex, and gives rise to consolidation and cavitation. The classification is also rendered more difficult when a number of organs in the body are attacked, as we have to speak of a general tuberculosis rather than tuberculosis of the lungs, and some cases in which the lesions are widely distributed may be referred to diseases of the respiratory system or diseases of the alimentary canal. In the majority of cases of general tuberculosis the principal stress falls upon the lungs, mediastinal glands, mesenteric glands, peritoneum and intestine; in a lesser degree upon the liver, spleen, and kidneys; and in the last stage the membranes of the brain are frequently attacked.

We have already discussed the subject of chronic tuberculosis of the lungs (p. 245); we will now speak of the acuter forms of general tuberculosis.

Acute Miliary Tuberculosis.—Acute miliary tuberculosis is perhaps commoner in early life than it is in after years; it occurs at all ages during childhood, though it is rare before the end of the second year. Like tubercular meningitis, with which it is often associated, it usually supervenes in children already tubercular, and occurs but rarely in children who up to the time of falling ill had been in robust health. There is usually a history of more or less ill health for some time previous to the attack; there is a history perhaps of whooping cough or measles some months before, which has left the child weak, and from which it has never really recovered. Sometimes the symptoms of a tuberculosis of the lungs or abdomen are unmistakably present, and then acuter symptoms supervene which mark the onset of the miliary form of the disease.

Acute miliary tuberculosis occurs usually in two forms: the *typhoid form*, so called because it is apt to simulate enteric fever, and the *broncho-pneumonic form*, in which the symptoms present are those of acute pneumonia, the latter being set up by the presence of miliary tubercle.

Symptoms.—In the **typhoid form** the commencement is usually insidious, and is usually preceded by a period of ill health, during which time the child has been noticed to waste, to be feverish at night, to cough, and not infre-

quently to suffer from diarrhea or pass slimy, unhealthy looking stools. The child is languid, irritable; its appetite is very uncertain, and it cares but little for its toys. Often there are decided signs of intestinal catarrh; the appetite is completely lost, the tongue is coated, and the abdomen distended. An examination of the chest may give no decided result, or only some rattle may be heard, and there may be no very decided cough. In this stage, if the symptoms are acute, the resemblance to an irregular attack of enteric fever is very close, especially if rose spots resembling those of typhoid are present, as is sometimes the case. The diagnosis is especially difficult in young children of three or four years of age, who are perhaps very irritable and resist any examination of the chest or abdomen, the difficulty being to distinguish acute miliary tuberculosis from enteric or subacute intestinal catarrh with some patches of broncho-pneumonia. A careful and continuous record of the temperature is important; the temperature should be taken morning,

afternoon, and evening; the variations are usually considerable, sometimes varying from 99° to 104° F., the highest being usually at 4 or 5 P.M. Too much stress, however, must not be laid on an intermittent temperature with considerable febrile, as in some children a patch of broncho-pneumonia without marked physical signs will be accompanied by a striking intermittent temperature. And, moreover, we have seen a case of miliary tuberculosis when the temperature only reached $101\frac{1}{2}^{\circ}$ or 102° in the afternoon or evening. Enlargement and tenderness of the spleen may be



FIG. 10.—Miliary Tubercle of the Choroid; eight weeks' duration. (From a drawing by F. H. Miles.)

present (in an early stage); in some cases there is a marked feeling of hardness about it. In one of our cases rigors, with enlargement of the spleen and an intermittent temperature, suggested malaria, but the case turned out to be acute tuberculosis.

Sooner or later, usually in the course of a week or two, more characteristic symptoms declare themselves. There is a dry hacking cough, especially troublesome at night; some crepitation or loose rales are heard at the apices, roots, or bases of the lungs, and not infrequently a sub-tymppanic or high-pitched note may be elicited on percussion, or perhaps there may be sign of fluid at one or both bases, with a pleuritic rub. In some cases there is marked dyspnea, out of proportion to the pulse-rate and fever; it is caused by the presence of miliary tubercles summed through the lungs, with perhaps some disseminated emphysema or broncho-pneumonia.

The hectic continues, and probably sooner or later, in the majority of cases, cerebral symptoms, due to meningitis or the softening of the brain which accompanies it, supervene.

One of the most important physical signs which may be present is that of miliary tubercles in the choroid; the discovery of these may not infrequently clear up the diagnosis of a doubtful case. Unfortunately the restlessness and irritability of children suffering from tuberculosis often render it impossible to make a thorough ophthalmoscopic examination. The tubercles appear as small, rounded, yellowish bodies, scattered about the fundus; one or more may be seen near the disc, but usually they are eccentrically seated: five or six may often be counted. Often a branch of a retinal artery or a vein may be seen to cross in front of one. They appear very rapidly, being apparently formed in the course of a few days; if there is tubercular meningitis, the disc may be swollen and indistinct.

In a case recorded by Froehling the detection of tubercular bacilli in the urine decided the diagnosis of a doubtful case in favour of miliary tuberculosis. In this instance the miliary tuberculosis was secondary to chronic tuberculosis of the kidney.

The duration of the disease varies, in some cases being short, often only three weeks; in others, perhaps the majority, it is longer, the patient lingering for six or seven weeks. The supervention of tubercular meningitis or broncho-pneumonia quickly brings the end.

The broncho-pneumonic form occurs most often in children from two to five years of age, and in the vast majority of cases is mistaken for an attack of acute broncho-pneumonia. There is often a history of measles or whooping cough shortly before the attack, and probably there has been a period of ill health with wasting. The symptoms are precisely those of acute broncho-pneumonia; there is fever, dyspnoea, rales, or crepitation are heard over an extended area of lung, with more or less impaired resonance over a corresponding area. The disease usually runs its course in about ten days to two weeks, death resulting from exhaustion and more or less asphyxia. The family history or previous health may suggest tuberculosis in any given case, but no definite diagnosis of tubercular broncho-pneumonia can be made unless tubercles are seen in the choroid. The supervention of meningitis suggests tubercle, but a simple meningitis may accompany or follow broncho-pneumonia, especially in infants and young children.

It must be borne in mind that acute or at least **subacute general tuberculosis**, which is not of the miliary form, may occur disseminated through all the organs. A tuberculosis may run a course of six weeks to two months, accompanied by hectic and wasting, and the principal lesions found *post mortem* are not miliary tubercles, though these may be present, but ragged cavities in the lungs, caseous bronchial and mesenteric glands, and caseous masses in the liver, spleen, and kidneys. In these cases the diagnosis may be difficult or impossible for the first few weeks, but careful examinations of the apices of the lungs will generally decide the question.

Diagnosis.—Acute miliary tuberculosis may be confounded with acute disseminated tuberculosis, in which the tubercular growth takes the form of caseous nodules or other forms rather than the typical purely miliary form. The diagnosis is of very little importance except as regards the acuteness of the case, the miliary form being necessarily the most rapidly fatal. Both miliary tubercles and caseous infiltrations may be found in the same organs. Acute miliary tuberculosis may be mistaken for typhoid fever,

subacute intestinal (usually acute) broncho-pneumonia, acute rubicundia, and pyæmia, and we may add influenza when the attack is prolonged, as it sometimes is for many weeks.

In making a diagnosis the family and personal history is of great importance; if other children or other members of the family have died of tubercular disease, the probabilities in a doubtful case will naturally be in favour of tubercle; but it must not be forgotten that apparently healthy children with a good family history will sometimes die of acute tuberculosis. A history of a recent attack of measles or whooping cough would be suggestive, but children with such a history may of course have typhoid or any other acute attack. There cannot be much difficulty in distinguishing a typical attack of typhoid fever from one of acute tuberculosis, but it may be quite impossible to make a diagnosis between an irregular and an acute attack of typhoid and tuberculosis. In both diseases there may be some looseness of the bowels, abdominal distension, and intermittent fever; in both the spleen may be enlarged. It is only by having the patient under observation for some days, and frequently examining the chest, that a diagnosis can be made. A short hacking cough, hectic fever, great variations of temperature, dyspnoea out of proportion to the temperature, and crepitation heard in the chest, would favour the diagnosis of acute tuberculosis. Any cerebral symptoms, such as convulsions, squinting, drowsiness, muscular rigidity, or paresis suggesting meningitis, favour the diagnosis of tubercle.

Some cases of broncho-pneumonia, where the distribution is patchy and the temperature markedly intermittent, closely simulate acute tuberculosis, and for a few days or a week a certain diagnosis cannot be arrived at. It is only perhaps when the pneumonia clears up, and the temperature tends to normal, that the suspicions of tuberculosis are relieved.

In acute endocarditis the temperature is apt to be hectic, and in the absence of a heart the diagnosis may be difficult. The presence of a heart would necessarily prove the case to be almost certainly acute endocarditis, in spite of it resembling tubercle in other ways.

Prognosis.—If the diagnosis of acute milary tuberculosis can be definitely made, the prognosis cannot be otherwise than exceedingly grave. There can be little doubt that in a few cases, at an early stage, before the milary tubercles are widely extended, recovery may ensue; but when the tuberculosis has become general very little hope indeed can be entertained.

Medical Anatomy.—The amount of emaciation present depends upon the chronicity of the case; we have seen at the *post-mortem* cases in which there was a fair amount of subcutaneous fat in those who had died of acute milary tuberculosis. On opening the chest, the lungs are found to be in a condition of deep inspiration, almost as if they had been injected with some fluid from the pleura, while milary tubercles are seen on the surface or beneath the pleura. On section the lungs are found stuffed with milary tubercles, of a grey colour and the size of millet seeds, usually so crowded that not a cubic inch in the whole lungs will be found free. They are mostly more crowded at the apex than at the base. Caseating or suppurating bronchial glands are almost certainly present. Frequently milary tubercles are present in the glands. Milary tubercles will be found crowded together in the bron-

spleen, kidneys, and serous membranes—frequently also in the choroid, and on the vessels at the base of the brain.

In other less acute cases caseation, necrosis and peribronchial tubercles may be found in the lungs, and may be associated with more or less miliary tuberculosis. It is curious to note that many observers have failed to find the tubercular bacilli in miliary tubercles, and others have found granular masses suggestive of spores (Boeckert, Robert, Malassez, and Vigani).

Treatment.—If the diagnosis of acute miliary tuberculosis can be made with certainty, little can be hoped for from the administration of drugs. The treatment must in such cases be a treatment of symptoms. If the temperature takes high excursions towards evening, quinine, aspirin, or antifebrin may be given to anticipate the rise, and the patient packed or sponged with cold water to reduce it. The trochilosteric cough may be relieved by cod-liver oil or nitrate doses of opium. The strength should be maintained by a liberal diet of beef tea, soups, port wine, Burgundy; contact of fruit and cod liver oil should also be given. Iodoform sometimes appears to be useful, though it can hardly be said to have any power in arresting the disease; it may be given in powder with sugar in half- to two-grain doses. The combination of digitalis and bark has appeared to us to produce a temporary improvement, but any permanent change for the better cannot be looked for.

Scrofula and Tuberculosis

In this work the word 'scrofulous' or 'strumous' will seldom be found, since we believe that all scrofulous or strumous lesions are identical with tuberculosis, or rather that they are mere varieties or forms of tuberculosis. Just as in the exanthemas and in gonæ, taking these as types of *parasitic* and *non-parasitic* diseases respectively, many variations are found in the form and extent of the lesions, yet each presents some single feature or group of features characteristic of its species, so in the scrofulous or tuberculous affections there is much variation, as it were, in the habit of the disease; yet the naked eye, or microscopic appearances, or the clinical history always reveals the unity of the affection.¹

In certain children there is a characteristic tendency to inflammation from trivial causes; this inflammation is apt to occur in, or rather pick out, the lymphatic tissues; once aroused, it tends to spread, attacking often distant parts of the body. If its course is slow, the foci of disease tend to become caseous; once started, the process seldom stops, or rather, though it may be arrested for a time, it is apt to be set going again by slight causes, even after long intervals of time. This tendency is found to run in families, some members showing one form of lesion, some another. At times different forms occur at different periods or even simultaneously in the same child.

There is often, though by no means always, a characteristic appearance of the patient, but it is quite common to find the disease under discussion in children not at all answering to either description. The types usually described are: 1. Scurfous type—the child is tall, slight, graceful, with small fine limbs, clear skin, and fine silky hair; the intelligence is bright.

¹ *Pediatric Clinician*, *Am. Clin.*, October 1884. *Kong-tai*, November 1884.

= Phlegmatic type—the child is short and thick-set, with coarse skin and limbs, thick features, and a dull, fishy aspect. 3. 'Pretty scrofulous' type—which is intermediate between the two former.¹

The evidence of identity of scrofula and tubercle from the clinical history is best seen in two ways: first, that in a given number of cases where either condition is present, inquiry will show a large proportion in which there is a history of lesions in other members of the family,² these lesions being often, as it were, crossed: thus the child with disease of its hip has a brother with chronically enlarged cervical glands, and the father died of some phthisis. Why should we call the father tuberculous and the children 'scrofulous'? Or again, the child with a 'puffy' knee may develop caries of the spine and then die with grey tubercles in its lungs and abdominal viscera, or suddenly be attacked with tubercular meningitis. Or again, a child with a 'scrofulous' joint disease, after some violent manipulation, perhaps forcible straightening of a flexed knee or imperfect removal of diseased tissue, rapidly develops yaws-like lesions, having had no sign of it before. There is strong reason to believe that in some of these cases there is direct tubercular embolism or general rapid distribution of tuberculous infection mutual throughout the body. Take one more illustration: a child with 'strumous dactylitis' develops along the course of the lymphatics of its arm multiple 'strumous nodes,' and finally suppurating glands above the elbow and in the axilla; these would be called scrofulous abscesses and scrofulous glands, yet they are simply tuberculous emboli from the finger. Treves looks upon scrofula as a phase of tubercle; the phthisical parent has scrofulous children. He found a history of phthisis in thirty-eight out of sixty-five cases of scrofula. A child begotten of parents, one of whom, perhaps especially the father, is at the time actively phthisical, is certainly exceedingly likely to be tuberculous. This we have seen more markedly. Tuberculosis may even occur congenitally. Dr. Morgan records a case of 'scrofulous sores' on the head and sides of a two-months foetus (*Path. Soc. Trans.* vol. xxiii); and Driescheld has described a tubercular testis in a newly born infant.

Anatomically, in the subjects of 'acute tertiary tuberculosis' we find always, or nearly so, somewhere in the body, caecum foci which if seen alone would be called scrofulous. Examined microscopically, the evidences of chronic inflammatory change undergoing degeneration—the characteristic tubercle, the giant cell, the tubercle bacillus—are all found in almost all the lesions classed as scrofulous, though much less abundantly in some tissues such as bone, than in others. It is then wise on all grounds to consider all scrofulous and strumous diseases as tuberculous, and therefore to be on our guard against the onset of tuberculosis in vital parts: for instance, the common chronic osteomyelitis of the finger may be the only discernible lesion in an apparently robust child, yet that child is infected with tubercle, and may at any time develop other foci, and any one of visceral tubercle; hence none of these diseases should be looked upon as trivial. It must, however, be remembered that there is much evidence to show that there is some antagonism between local 'scrofulous' lesions and general visceral tuberculosis, or rather that so long as the local lesion is unremoved

¹ Vide Treves on Scrofula and Gland Disease.

² Vide chap. on Joint Diseases for figures on this point.

the internal organs escape, while recovery from the local disease may be followed by general infection. This has given rise to the view that the local disease acts as a sort of safety valve. It is probable that the truth is that so long as the local lesion remains quiescent, or, as it were, encapsuled, no general infection takes place, but if from any cause the tuberculous material gains access to the neighbouring vessels or lymphatics, a rapid dissemination of the tubercle is brought about. The disease often lies dormant for years or for a long lifetime, and the patient may never show any further sign of tuberculosis; we must therefore not condemn all these children as hopelessly tuberculous. Indeed the tendency to develop tubercular foci often dies out after a time, and the child becomes quite sound. Such children should be taken care of more watchfully than others need be, and no source of irritation, however slight, be allowed to continue; canous teeth, little patches of herpes or eczema, slight injuries, and so on, should be seen to at once, lest chronic inflammation should ensue and a tubercular nodule be established. The diet in all such cases should be especially nourishing, and the usual remedies of cod liver oil as an article of food rather than a medicine, iodine in some form, iron, and, above all, sea air, should be provided where practicable. In the richer class of patients such children should go to school by the seaside.

Details of management of individual lesions will be found in the various special chapters.

Tubercular Adenitis.—As already pointed out, the lymphatic tissues are those most commonly and most extensively attacked by tuberculosis,¹ and lymphadenitis is commoner than lymphangitis, since any solid material taken into the lymphatic vessels is apt to be arrested in the adjacent gland. The thick lips and nose and the red patches and eczematous eruptions of children are, as pointed out by Curran,² 'reticular lymphangitis.' Under certain circumstances chilblains are probably a similar condition. Irritating matters passing up the lymph stream are not, however, by any means always arrested at the nearest glands, partly because the course of the lymphatics varies, and the most commonly affected glands may be avoided by a by-route and those farther on attacked, and partly because the material probably may sometimes pass through one gland and involve the next, or after one gland has become inflamed it may become a source of infection to the next in the chain. Hence search should be made for sources of irritation not of the usual path if none are found in the common positions. If one obvious enlarged gland exists the presence of others should always be suspected. The first thing, then, when a child is brought with an enlarged lymphatic gland, is to examine the whole area draining to that gland for some source of irritation, past or present: this will be facilitated by the following table, where the principal lymphatic glands and their collecting areas are given.³

¹ Georg Smith has remarked upon the frequency of lesions of 'red mucus' as an indication of its lymphatic affinity.

² Curran, *Lancet*, 1879. *Supper, Anst. Phys. Publ. der Pariseren Académie*, Paris, 1874.

TABLE SHOWING THE DISTRIBUTION OF THE LYMPHATIC GLANDS AND THEIR DRAINAGE AREAS.*

GLANDS	HEAD AND NECK	
	DRAINAGE AREA	
<i>Submyeloid</i>	}	drain posterior half of head.
<i>Mandibular</i>		
<i>Parotid</i>		
<i>Submaxillary</i>		drain anterior half of head, orbits, nose, upper jaw, upper part of pharynx.
<i>Subhyoid or submental</i>		drain the lower jaw, lower part of face, and front of mouth and tongue.
<i>Superficial cervical</i> (lying beneath platysma)		drain anterior part of tongue, chin, and lower lip.
<i>Deep cervical</i>		drain external ear, side of head, and neck and face.
<i>Inter-pharyngeal</i>		drain nasal fossa and pharynx (upper part).
<i>Upper set along sternal sheath</i>		drain mouth, trachea, palate, lower part of pharynx, larynx, posterior half of tongue, nasal fossa, parotid and submaxillary glands, interior of skull, and deep parts of head and neck.
<i>Lower set in supra-clavicular fossa</i>		drain upper set of lymph glands, lower part of neck, and axillary and mediastinal glands.
<i>Upper Extremity</i>		
<i>Supra-axillary</i>		drain three from fingers.
<i>Subscapular</i>		drain upper extremity, dorsal and scapular regions, front and sides of trunk and breast.
<i>Lower Extremity</i>		
<i>Anterior tibial and popliteal</i>		drain the deep lymphatics of the leg, and receive some vessels from the skin of the leg and foot, chiefly the outer side.
<i>Inguinal</i>		
<i>Femoral set (superficial)</i>		drain superficial vessels of lower limb and partly of buttock and genitalia also perineum.
<i>Horizontal set (superficial)</i>		drain abdomen below umbilicus, breast and genitalia.
The deep vessels of the lower limb go to the deep glands along the femoral vein.		

* Mostly from Lawson and Treves.

* Occasionally there are glands in the bend of the elbow.

	Glands.	Adenitis.
<i>Blas.</i>		drain the pelvic viscera and the deep vessels of the genitals partly.
<i>Lymphat.</i>		drain all the lower glands, uterus, testes, ovaries, kidneys.
<i>Sacral.</i>		drain the rectum.

Roughly, the umbilicus is the watershed draining to the axilla and groin, but the vessels cross and overlap both vertically and horizontally.

Perhaps the most commonly enlarged glands are those of the neck and submaxillary regions, parts obviously much exposed to irritation; thus eczema of the scalp, the irritation of pediculi &c. give rise to enlargement of the occipital and upper cervical glands; herpes about the nose to irritation of the paired or submental glands; white canous teeth, ulceration of the gums, and so on, affect the submaxillary and cervical groups. The upper set of cervical glands are found enlarged from irritation of the meatus externus in cases of earache and in cases of tonsillitis. As already mentioned, a lymph gland overlies the breast, and is usually enlarged in affections of that structure, which is not perceptible from the neck under ordinary circumstances. Treves points out that those glands which drain areas rich in lymphoid tissue are the ones most commonly enlarged; hence the cervical, bronchial, and mesenteric groups are those most often affected.

The enlargement of lymphatic glands is sometimes acute at first, and they are then tender and painful; in other instances the swelling is chronic and painless from the beginning. The glands form hard, rounded, or oval masses freely movable in the deeper tissues and beneath the skin, unless there has been cellulitis around the gland (periglandular inflammation). In chronic cases the overlying skin is normal, and usually several glands can be felt; often a chain of them, varying in size from a pea to a walnut, can be traced. A more transitory irritation may start inflammation in a gland, and then, though the local source has entirely disappeared, the enlargement may persist and other glands in the chain be affected, as already described; hence we must not conclude that there has been no primary source of irritation, and that the glandular affection is spontaneous because we can find no cause for the enlargement. Cold, or some trifling injury, a sore upon the skin of mucous surface, soon healed and forgotten, or perhaps never noticed, is sufficient to set up chronic tubercular adenitis, which may spread and last for months or years. Primary adenitis not due to absorption is probably very rare. Treves points out that cervical adenitis may be caused by extension from within the chest or other distant parts.

After a time, unless the process subsides, the glands become very hard, and by their size and number give rise to great disfigurement and occasionally to more serious trouble. Goody, of Cincinnati, has recorded a case of death in a baby five months old from pressure of a cancerous gland upon the carotid sheath. These swellings are seldom painful; after a time one or more patches of softening may appear, and as the process goes on the skin becomes

red or livid, and fleshy, thickened and perforated; this watery, very purulent fluid with flakes of lymph and cheesy matter then escape, more rarely fairly healthy-looking pus; occasionally the discharge is clear glairy fluid, like the contents of some mucous cysts, but in such cases there is almost always some more purulent matter at the bottom of the cavity, which can be squeezed out. The discharge may go on indefinitely, and an ulcer is formed which has little tendency to heal, and is bounded by thin firm undermined, unhealthy edges. If healing does take place the scar is pockered and unsightly, often with bridges or tags of thin insensitive skin hanging from it, and little black spots due to accumulation of dirt and secretion in the hollows of the scar. Such is the condition seen in an old 'scrofulous neck.'

If such a gland as that above mentioned is examined in the early stages of the process, it will be found firmer and paler than in health, but not otherwise obviously altered; a little later patches of yellow cheesy material of various sizes will be found scattered through the gland, sometimes in one or two large foci, at other times in numerous small ones; the capsule of the gland is thickened. Later still, these caseous foci break down, the greater part of the gland tissue is destroyed, and the gland itself becomes converted into a bag of cheesy or flaky pus and detritus, with walls composed of the capsule and more or less of the gland tissue remaining unabsorbed. It happens, however, sometimes that, instead of the gland breaking down and softening in the centre, suppuration takes place in the cellular tissue round it—*periglandular abscess*; this burrows round the gland and isolates it, so that there is a solid mass of gland tissue lying in an abscess cavity, and perhaps attached to the surrounding tissues only by the structures passing to its hilus. In this last case, when the skin gives way, instead of a deep ulcer there is seen a round pinkish or yellowish-white mass projecting from the middle of a circular sore, the edges of which are low, undermined, thin, and firm; there is often but little discharge, and no tendency to heal, or, indeed, to alter much one way or the other. Where many glands are enlarged, all stages, from the first primary enlargement to the last named condition, may be seen at once, and sometimes the whole neck from ear to ear is marked by ulcers, scars, and enlarged glands in various stages. In such cases it will easily be found that many teeth in one or both jaws are carious, and acting as sources of irritation.

It must, of course, be remembered that all such glands do not go on to suppuration, and perhaps in children there is more chance of resolution than in adults; however, the majority do suppurate if they remain enlarged for more than a short time.

Consistent with the glandular abscesses and sores will often be found superficial ulcers, round or irregular in form, often crusted over, and only discharging at times. The edges of the sores are usually unhealthy and undermined, and their bases glazed or covered with coarse, unhealthy granulations and caseous detritus; some of the ulcers are no doubt caused by the discharge of broken-down glands; in these a small aperture will be found leading down to the underlying gland; others are probably due to abscesses beginning in lymphatic vessels, due to tubercular lymphatic vessels, or rather thrombi—tubercular lymphangitis, 'strumous nodes'; others again probably to local cutaneous tuberculosis.

Diagnosis.—Tuberculous adenitis and ulcers may be mistaken for syphilitic ulceration, which gives rise to very similar appearances, except that ulceration predominates over the glandular enlargement. It must be remembered that congenital syphilis and tuberculosis may coexist. The presence of other evidences of syphilis will nearly always clear up a doubt.

Simple acute adenitis is recognised by its short history and by the pain and great tenderness of the part, as well as by the presence of an acute source of irritation, such as an abscess or acute tonsillitis, and by the fact that usually only one gland is enlarged, though several may be tender.

Simple non-tubercular chronic adenitis may occur as the result of acute inflammation, but this usually rapidly subsides under treatment and affects but one gland; if the affection is obstinate, suspicion of its tuberculous nature should be aroused.

Lipous ulcers are the only other condition likely to be mistaken, and as



Fig. 84.—Tubercular Ulceration of the Sole of the Foot, showing (enlarged) lymphatic nodes underlying the tuberculous granulations. A form of so-called Lipous hypertrophy.

these are also tuberculous, the mistake is of little importance. The presence of well-defined lipous tubercles is the distinguishing feature.

Tuberculous abscess of the skin, 'scrofuloderma,' 'scrofulous gumma,' and 'sourness node,' are the names applied to small tuberculous foci probably in the lymphatics which, at first hard and solid, usually break down, though sometimes they are absorbed. These little swellings are often found in the thickness of the skin (as about the limbs, face, or trunk). Occasionally the mischief spreads, and a large cold abscess or tuberculous ulcer may result.

Chronic tonsillar hypertrophy is considered by Treves to be 'almost pathognomonic of scrofula'; though very common in tubercular children, we think it is often met with in those who show no other signs of tuberculosis; it may occur during the first few months of life. Infantile leucorrhœa and certain vulvar ulcers have been supposed to be tuberculous; no doubt many cases of anal suppuration are so.

Treatment.—The treatment of tuberculous adenitis consists at first in carefully removing all sources of irritation; carious teeth, enlarged tonsils, patches of eczema, nasal catarrh, otitis, chafed heels, and so on, should all receive attention according to the seat of the enlarged glands and the source of the trouble. Next, the general measures of diet and health already mentioned must be carried out. As to the local treatment of the glands themselves, this must be managed according to the stages of the disease. (1) In the early stage, before cavernous foci have appeared, after removal of the source of irritation, the glands should be left quite alone, in the hope of their subsiding. If no improvement takes place in a fortnight, the glands should have a piece of *unguentum plumbi iodidi* or *unguentum hydrogeni* of the size of a small pea gently rubbed over them night and morning. Friction with tincture of iodine we do not approve of; it is far more likely to increase the irritation of the glands than to lessen it. Should the enlargement not yield to these means, and should the stage of cavitation, known by a duration of two or three months with considerable enlargement and much hardening of the glands, be reached, the best treatment is to cut down upon and shell out the glands entire—a very easy operation at this stage where only one or two glands are involved, a much more difficult and sometimes impossible one where many glands in a chain are enlarged and there is periglandular inflammation. In favourable cases an incision through the skin and fascia, and then through the sheath of the gland, followed by pressure at each side with the fingers, will render excision of the mass quite easy. All the glands felt to be enlarged should be removed, all bleeding stopped, and the edges carefully brought together, no drainage being used if the wound is clean. The resulting scar is slight, and much less unsightly than that left in cases where suppuration has gone on. The plan of pressure with the thumb-index finger we have not found satisfactory; it is apt to leave intractable sinuses.

In the next stage, when the gland has softened down, if there has been no periglandular mischief, it may be still possible to dissect the mass out, and, if so, this is the quickest and best method; it is, however, impracticable if the glands have become matted to the surrounding tissues: in such cases the abscess should be opened by an incision about half an inch in length; a long incision is not necessary, but it must be sufficient for free manipulation and drainage. After opening the abscess a Volkmann's spoon is pushed in, and all the gland tissue carefully and thoroughly scraped away: if any is left the wound will not heal, but the part remaining will caseate, break down, and keep open a sinus; hence, if all the gland cannot be scraped away, the most satisfactory plan is to enlarge the incision and dissect out the remaining parts. Some surgeons recommend a small opening, and leaving the abscess to slowly drain. Injection of chronic glandular abscesses with a solution of iodoforn is either well worth a trial; we have seen them completely disappear under this treatment. When, as often happens, two or more glands unite, but not fused with one another have broken down, the further ones may often be reached, as pointed out by Mr. Teale, by thrusting the spoon through the adjacent walls and thus emptying all the cavities through one opening. The wound should be well dressed with iodoforn and drainage provided for. When the abscess has already burst and left a sinus, the same treatment

should be adopted. Where ulcers have formed with undermined edges these should be scraped or clipped away flush with the healthy skin; a large vessel may thus be sometimes left where there was but a small opening before, but the ultimate result will be a much less unsightly scar, as well as more rapid healing, if this devitalised skin is removed; all the unsightly tags and bridges will be thus avoided.

Where there is a protruding isolated gland in the middle of a sore, if it is soft it may be scraped away; if not, we have found Golding-Bird's little electrolytic caustic apparatus serviceable. The silver plate is fastened by a strip of wrapping on to a neighbouring sore if there is one, or, if not, on to a surface made raw by a blister, and the copper wire is bent so that the zinc arrow can be plunged into the middle of the gland; a strip of wrapping fixes the arrow, and a bandage is applied over all. The apparatus is left on for forty-eight hours, or more in some cases; at the end of that time the gland will look yellow and dry; the apparatus is then removed and a hot boric lotion dressing applied for twenty-four hours, when the gland is usually found to come away; if more glands remain, the apparatus may be reapplied. In this method there is a deposit of nascent chloride of zinc in the gland which quite painlessly and rapidly destroys it, and we have never seen any tendency to extensive sloughing, nor anything except good results, from this mode of treatment in suitable cases; it is, of course, only valuable where objection is made to removal of the gland by operation.

Mr. Teale has pointed out that where one superficial gland is enlarged and suppurating there is usually another, lying beneath the deeper fascia, and that, unless this is cleared out, the source of discharge is not removed and the sinus will not heal. It is necessary to look carefully sometimes to find the channel leading to the deep gland, but it is there and must be followed by the spoon, and the second mass removed. Mr. Teale uses a special dilator to stretch the sinus, but a dressing or sinus forceps will usually be found to answer all purposes.

Iodoform is the best dressing to apply to these sores at first, and later on they do very well with iodide of lead ointment.

When several sinuses are left in the neck it is a good plan to use, as advised by Treves, a gratta-percha or leather stock to keep the parts at rest (the wire-net collar will be found useful for this purpose), and in other parts of the body efficient pressure by pads and bandages or by a brass is often useful.

Where depressed soars remain after gland disease Adams or Reeves's operations may be employed. The former loosens the skin by subcutaneous division of the scar, and by daily manipulation keeps it from becoming attached till the hollow is filled up. Reeves props up the depressed skin upon a wire passed beneath it, which may be left in permanently, or removed if it sets up irritation. We have had a good result from the latter method. A far better plan, however, in most cases is to cleanly excise the whole scar, and bring the edges of sound skin accurately together by means of sutures; thus a linear cicatrix takes the place of the irregular puckered or depressed scar.

Acute non-tuberculous glandular abscesses in parts of the body other than the neck are often met with, and require treatment on general principles.

Where the popliteal or inguinal glands are involved the limb should be kept extended and fixed to a splint. Suppurating popliteal glands are apt to give rise to serious trouble; the matter tends to burrow far up the limb. In one case we had to amputate the thigh where an abscess, beginning in the popliteal lymphatics as the result of an irritated chloasma, eroded the popliteal artery, opened into the knee joint, and burrowed up to the pelvis.

Acute adenitis, if seen before suppuration has occurred, will usually subside if the source of irritation is removed and the part well forecausted after aneuring it with extract of belladonna. If pus forms it should be let out as soon as possible.

Chronic Abscess.—Chronic abscesses may now be dealt with much more speedily and satisfactorily than in former times. In all cases, of course, the source of irritation should be looked for and if possible removed; unless this is done success cannot be reasonably expected.

In some instances, if the contents of the abscess are drawn off through an aspirator and an emulsion of iodoform in glycerine injected (from $\frac{3}{4}$ —50 being a usual quantity in use), the abscess will slowly subside. This method is not, however, likely to succeed where any irritating or track-causing material is present. In such cases the abscess should be freely opened and its contents and whole lining most carefully scraped and rubbed away; this part of the proceeding must be done thoroughly or the operation will fail.

The abscess cavity should then be well washed out with perchloride of mercury lotion of strength 2 in 1,000, and, after being thoroughly dried out, either a mixture of iodoform and boric acid in equal parts should be dusted in, or some of the iodoform emulsion injected. The wound is then to be carefully and completely sewed up, all excess of fluid being squeezed out just before the dressings are applied. The dressings should consist of wool-wool wadding or some similar substance packed carefully on over a layer of wet gauze. The dressing should be so applied that the walls of the cavity are accurately kept in contact and firm pressure made. In successful cases the wound need not be disturbed for ten days or a fortnight, when it will be found soundly healed. If, as sometimes happens, the wound heals but the abscess refills, either the source of irritation at a distance has not been removed, or the cleansing out of the cavity has not been complete; the operation should be repeated, and will probably be successful. In clearing out the cavity it is useful to twist an artificial sponge tightly into all parts of the cavity and screw it round so as to entangle and wipe out all noxious material.

Deep Cervical Cellulitis—Angina Ludovici.—A very serious affection; the mischief apparently begins as a periglandular inflammation, goes on to sloughing, and may perforate the cheek. There is at first a brownish infiltration of the submaxillary region; the skin in milder cases is pale and marked by varicose veins; in the more severe and acute cases, however, a deep brownish-red discoloration appears. The whole neck may be involved, and there is great swelling, with marked protrusion, and sometimes dyspnoea or dysphagia from mechanical pressure. The disease is met with usually in children under three years of age, often in infants, and occurs under similar conditions in cancerous oris. Early and free incision is urgently required; usually with

feet between scrotum or semi-pen escapes. Free stimulation and abundant nourishment are required, with removal from insensatory surroundings. The necroticity of these cases, which much resemble those of scrofulous cellulitis, is considerable.

CASE.—Female, age 1 year 3 months; foot swollen 2 fortnight ago; on admission, right side of neck sore, hard, brownish-red; swelling reaches to clavicle; swelling incised, serum only escaped; scabs from left arm removed; skin sloughed freely, and peritonitis set in, child dying on seventh day.

Post-mortem.—Abscess in lungs and sanguinous pleuritic effusion.

General Surgical Tuberculosis

A condition perhaps best described as 'general surgical tuberculosis' is common, the term being applied to those cases where there are tuberculous foci scattered here and there over the body in various tissues. Thus children are seen with ulcers of the hands, abscesses or still unsoftened nodes along the course of the lymphatics of the foot-arm, and a supracardiac gland enlarged; perhaps a patch of ulceration on the cheek and submaxillary adenitis, phlyctenular ophthalmia, tubercular osteomyelitis of one tibia, with disease of the tarsus on the opposite side, and so on. Such a combination is by no means a rarity: not very long ago we had in the hospital a boy with disease of one hip, one elbow, one ankle, and sacro-iliac disease; in another the shoulder, ankle, and wrist were all excised for tuberculous disease. Such cases, if they are neglected, gradually lose strength and sink, but good food and sea air, combined with removal of the disease as soon as it is evident that spontaneous repair is impossible, will often work wonders.

Operation should be deferred till it is seen what nature can do; but if with the improvement in the child's health no progress is made locally, or if there is pain or much discharge, the affected tissues—bones, joints, &c.—should be removed. We have often been surprised at the rapid and complete repair effected in such children, and even in the cases looking most desperate locally, resections or scrapings will sometimes succeed and amputations prove unnecessary.* But in all these children relapses will occur if the health is again allowed to fall from bad food and hygiene.

As regards details of local treatment in such cases, we find iodoform mixed with an equal quantity of boric acid and dressed on, or iodoform ointment, the best application. Where operation is called for, all dead and carious bone should be excised or scraped and gouged away, all soft carcous and pulpy granulation tissue removed, and undermined livid edges of skin clipped off. The incision may sometimes be closed with sutures and primary union obtained; where possible this should be attempted. If, however, the destruction of the skin renders union impossible, the wounds should be left freely open; they often heal with great rapidity and leave but little deformity. Amputation is sometimes required for tarsal and knee joint disease, but in the upper extremity we have never seen a case that required it, except in the fingers, though some have at first appeared hopeless enough. Caries of the spine in such children is the most serious condition, from its

* See, however, chapter on Bone and Joint Diseases.

inaccessible position; but even this is not hopeless. It is not so common as might be expected to find visceral tubercle in these patients, and this is probably one of the reasons why they have been called *scrofulous* and not classed as *tuberculous*. The term '*surgical tuberculosis*' has been used to imply that operative treatment can do much for them, and that the lesions are external. The following case illustrates this.

Surgical Tuberculosis.—Edward C., aged 9 years 5 months. Admitted November 2, 1896. No tubercular history. Always healthy till two years ago, when an abscess appeared at the back of the leg, and others subsequently elsewhere—they have continued to discharge since. Four months ago he fell upon the elbow, and an abscess formed, which was opened, and has been discharging since; still still. The abscessum is now over the inner end of the left clavicle, leading to low fever. Abscesses and enlarged glands in the neck; a sinus on the left buttock and another over the inner condyle of the left humerus. Also, several small bone sequestra removed from the cavity in the clavicle due to and involving the acromioclavicular joint; abscess to neck scraped out and a deep gland beneath the fascia scraped away; some abscesses have scraped from inner costals of humerus. Arms much pain in elbow, which subsided partially by the rest; he did fairly well, and was sent home November 15 with all the abscesses closing well except the elbow, which remained painful and tender. Such cases are very frequently met with.

Diabetes Mellitus

Though diabetes is much less common in children than in young adults, it cannot be said to be rare, as Gerhardt has recorded 222 cases at various ages, from six months to fifteen years. Cases have been observed in infants at the breast, though the diagnosis in such may be open to doubt on account of the difficulty of obtaining the urine, and of the uncertainty of detecting small quantities of sugar in the urine. Little can be said about the etiology of these cases; a history of diabetes in the family may, however, often be obtained. Thus, in a family we are acquainted with two uncles died of diabetes, and two children, brother and sister, aged 14½ years and 2½ years. Another sister of 6½ years has sugar occasionally in the urine.

The symptoms noted are those which are present in adults. There is the thirst, dry skin, red tongue, marked thirst, and voracious appetite. There is often incontinence of urine on account of the large quantities passed. The specific gravity of the urine is high, 1020 to 1030 at noon, and perhaps 5 per cent. or even 10 per cent. of sugar may be found. The child usually wastes, especially if not carefully treated, and is apt to contract a fatal pneumonia. Tuberculosis or chronic phthisis may supervene as in adults. Diabetic coma has also been observed by several authors, and one has come under our own observation, though perhaps it is not so common as it is in the case of young adults. The symptoms commence with headache, dry tongue, and dyspepsia, followed by coma. It is well to bear in mind the possibility of being called to see a child who has rapidly passed into a state of coma without diabetes having been suspected.

The prognosis is mostly unfavourable, though cases are recorded which made apparently a permanent recovery. In the fatal cases the duration varies from a few weeks to a year.

Treatment.—All starch-containing foods and sugar should be forbidden, gluten bread and saccharin being substituted. Milk in moderate quantities

or cream may easily be allowed, as children are much more dependent upon milk as a food than are adults. Beef tea, soup, fish, chicken, and butcher's meat, with gluten bread and green vegetables, will chiefly form the diet. Much difficulty is often experienced in keeping children to a rigid diet, as they hanker after bread-and-butter or puddings. With regard to drugs, opium (gr. 2 to gr. 4) or opium should be given, while the bowels are carefully regulated with Castor oil salts or Rabel's water. Great care should be exercised to prevent the child catching cold or any of the zymotic diseases, since bronchitis, whooping cough, or scarlet fever is almost certain to unfavourably affect the course of the disease.

Polyuria—Diabetes Insipidus

The etiology of this condition is for the most part quite unknown, and it probably covers a variety of causes. Cases of brain disease, of contracted kidney, tuberculous kidney, and of functional diseases of the alimentary canal may be accompanied by polyuria. In the majority of cases no cause can be assigned, and we are obliged to speak of such as idiopathic, much in the same way as we speak of idiopathic anemia. In a large class of cases polyuria is temporary only. Children, often girls between three and six years, are noticed to wet their beds, or make water in the day time far more frequently than they have been accustomed to. In the same way boys will wet their trousers frequently during the day when it was thought that they had grown sufficiently old to have learnt proper habits. An examination in such cases will probably show to abdominal distension of the urine, but that it is of low specific gravity, perhaps 1005 to 1010, and passed in larger amount than usual. Possibly there may be a trace of albumen. In the majority of cases this condition will be found to depend upon digestive derangements or improper feeding; it appears to be a reflex irritation of the kidneys, the source of irritation being in the intestine, the presence of an intestinal catarrh being the cause. Possibly also the deposition of uric acid salts in the kidney may be the cause of a large quantity of watery urine being secreted. The presence of thread worms or round worms in the intestine or rectum also appears at times to produce polyuria. In those rare instances of contracted kidney occurring in childhood large quantities of urine are sometimes passed; in such cases the specific gravity is low, but there will usually be some albumen.

In those cases to which the name of 'Diabetes insipidus' is usually applied there is intense thirst, and large quantities of pale urine with a specific gravity of 1002 to 1005 are passed. A girl of 8½ years under our care, who had suffered for some six months, drank as much as ten quarts in twenty-four hours, and passed a proportionately large quantity of water. When restricted to ten pints of fluid daily, she would at the night crawl under the bed to the bath-room to obtain water, or surreptitiously drink her own urine. Such patients have dry, rough skins, are anæmic, and of irritable temper. The course of such cases is exceedingly chronic, and permanent cure is seldom obtained.

Treatment.—The treatment must depend on the cause. If simply reflex, dependent upon intestinal irritation, a calomel purge may be given and a

carefully restricted diet prescribed. In confirmed cases of Diabetes insipidus various drugs have been tried; opium, strychnine, valerian, and ergot usually fail; in our own case no drug seemed to check the secretion of urine in the least—a temporary improvement took place during an incoincident attack of tonsillitis. In all cases the patient should be warmly dressed and protected from cold, as a chill has the effect of checking the perspiration and so increasing the secretion of urine.

Rheumatism

Rheumatism, either in its acute or chronic form, is not common during the first four or five years of childhood; it is commoner after this age, but typical attacks of acute rheumatism occur less often in children than in young adults. Concerning the etiology and pathology of rheumatism but little need be said: hereditary influences, the effects of cold and damp, the retention of waste products in the blood, and the poison of scarlet fever, seem in greater or less degree to predispose to or excite an attack of rheumatism.

Symptoms.—These in older children closely resemble those seen in adults, except that the attacks are rarely so severe, but being rather in the category of subacute, the attacks being less severe and of shorter duration. The illness sometimes begins with vomiting and chilliness, but more often the first thing complained of is pain and tenderness in the larger joints, which may become red and more or less swollen. The commonest joints to be affected are the larger ones, such as the knees, ankles, hips, wrists, and shoulders; these are rarely all affected at the same time or indeed in the same attack; much more commonly one or both knees are distended with fluid, while subsequently a wrist or an ankle becomes red, tender, and swollen. The joints of the cervical vertebrae are often affected, and occasionally some of the smaller joints, such as the fingers. There is no often much fever, the temperature rarely exceeding 102° . Usually there is not much swelling, the joints quickly recover themselves, and the pain and immobility disappears in a few days. Sometimes the only evidence of a rheumatic attack is a slight redness and tenderness about a single joint. It is the exceeding mildness of these attacks as well as the want of intelligence to localise their pain that make attacks of rheumatism readily overlooked in young children. A crying out when disturbed, with a certain amount of pallor or irritability about a limb, may be all there is to indicate an attack of rheumatism, which, mild as it may be, is yet perhaps accompanied by endocarditis which may inflict a life-long injury.

Distinct attacks, however, may be noted in young children, of which the following, a patient seen with Dr. Earle, may be taken as an example:

From Rheumatism.—A little girl of twenty-two months was going about as usual on March 10; on being taken up the next morning she seemed in pain and was unable to stand, complaining (apparently) of her left ankle, which was supposed to be sprained. The next day, however, the right ankle appeared to be similarly affected, and during the succeeding two days her knees, elbows, and neck were attacked successively in the same way. On the fifth the knee joints, especially the left, were considerably swollen and hot with tend in the joints; the next day both joints were equally enlarged. The general system was only slightly disturbed; there was no cardiac affection. The knees remained swollen for a few days, but gradually recovered, so that at the end of thirteen days she could again walk a little.

In most attacks the child becomes anæmic. Children, like adults, are liable to relapses; usually fresh joints are affected, with the symptoms attendant on the primary attack.

The complications and manifestations of rheumatism are many and of great importance, as they all centre round **post-endocarditis**, and it is the danger of these cardiac lesions supervening that makes us look with so much care and anxiety at all joint pains in children. As already remarked (see p. 396) it is the exception for children to escape suffering from endocarditis during an attack of acute rheumatism, and, moreover, peri-endocarditis may supervene with but very slight joint pain, or the latter may come on later.

Chorea is another frequent associate of rheumatism, and may either precede or follow, or sometimes actually complicate, the rheumatic attack. It has been referred to elsewhere.

Pleurisy and Picuro-pneumonia occur at times as complications of a rheumatic attack, especially when pericarditis is present.

Erythema multiforme and **Urticaria** occasionally occur in connection with rheumatism and endocarditis. The erythema may take various forms, occurring sometimes as irregular patches of redness, at others as red or white papules. **Erythema nodosum** is not uncommon. In all cases where such forms of erythema occur, the heart should be carefully examined. **Purpura** occurs also at times in rheumatic attacks. Peculiar **nodules**, first described by Drs. Barlow and Warner, occur in some rheumatic cases, mostly in the neighbourhood of joints. They are subcutaneous, the skin being freely movable over them; they are most common at the back of the elbows and wrists, at the ankles, and by the patella. In one case seen by us, that of a girl suffering from severe chorea and rheumatism, there were several hundreds of these nodules, many of them being situated over the bones; friction during the severe movements seemed to act as the exciting cause. They were present at the back of the scalp, over the spinous processes, along the edges of the scapula, and along the ribs. They are not painful, and vary in size from a split pea to an almond. These nodules are, when present, associated with chronic heart disease.

Dagnosis.—There is often much difficulty in distinguishing the synovitis which accompanies rheumatism from one or other of the many other forms of synovitis. Thus there is the acute suppurative arthritis of infants, the synovitis of septicaemia and scarlet fever, and the synovitis which is apt to given to effusion and has a chronic course which chiefly attacks the knees; there are, moreover, the rarer arthritic attacks which accompany leucoplæmia, syphilis, gonorrhœa, and purpura. It may be impossible definitely to say if some arthritic attacks are really rheumatic or not; their subsequent course may possibly clear up the doubt. In infants and young children it may be difficult to localise the seat of pain in a limb, and consequently a doubt may be raised as to whether in a given case where there is pain and tenderness the joints are affected or not. Such difficulty may arise in the epiphyseitis of congenital syphilis and in the tenderness of the periosteum and occasional hæmorrhages which are associated with rickets.

Treatment.—On the least suspicion of any joint affection in a child it should be put to bed between the blankets and restricted to a milk diet. It

is a comparatively small matter if we are over-cautious in our treatment, in keeping at rest in bed a child who has but slight joint trouble and who appears to the friends to all little ; while it is a grave matter to allow a child who is suffering from incipient endocarditis to get up and run about, or to suffer one to contract endocarditis in consequence of getting up. Knowing the readiness with which peri-endocarditis supervenes in mild attacks of rheumatism in children, it is our duty to warn the friends of this, and to insist on placing the heart under the most favourable circumstances by giving it as little work to do as possible. This is best accomplished by keeping the child at rest in bed, perhaps for several weeks, after all pain and tenderness have disappeared.

In the milder cases the only medicine required will be a simple saline such as citrate of potash ; the affected joints should be painted with extract of belladonna and glycerine, and surrounded with cotton wool. A small dose of Dover's powder may be given at night. In the more severe cases where many joints are affected and there is much fever, salicylate of soda should be given ; five to ten grains may be given every four hours to children of from six to eight years of age for two or three days, and then given only every six hours or three times a day ; it may be prescribed with a saline or given with syrup of orange peel.

In all acute or subacute cases milk is the best form of food ; it may be given in combination with potash, soda, or salted water ; as long as there is any fever this should be allowed to. There is always a risk of a relapse if beef tea, soups, or meat are allowed too early during convalescence. Arrowroot, rice, and custards may be allowed when all pain has been absent for several days and the temperature has been normal for a week.

CHAPTER XVIII

GENERAL DISEASES

Rickets

RICKETS is a disease that usually makes its appearance during the first two or three years of life; it is characterised by chronic indigestion, deformities of the bones, weakness of the muscles and ligaments, and various peculiar nervous disorders. Dentition is retarded; there is frequently enlargement of the liver and spleen.

The commonest time for rickets to manifest itself is from the first six months to the end of the second year, but it is not uncommonly noted during the first few months of life, and in rare cases infants may be born exhibiting undoubted rickety changes in their bones. During the first year or two of life, even in health, the digestive system is worked to its utmost capacity, in order that it may be able to supply the system with sufficient nutrient material, not only for the exigencies of daily life, but also for the rapid building up of the tissues which is going on at this time: an impairment of the digestive powers, a weakening of the digestive ferments, or food inadequate in quantity or of an improper kind, necessarily means that the tissues fail to receive the amount of nutriment they require. This failure of the nutritive powers is an important factor in bringing about the changes which characterise rickets. That a state of mal-nutrition does not always produce rickets is certain, but it is certainly true that it often does, and, moreover, in all cases of rickets of any degree of severity there is evidence of a pre-existing failure of the digestive powers. In some of the milder forms of rickets, when the ribs are seen to be beaded and the bones of the extremities deformed, without any of the symptoms which mark the severer grades, the child may be fat and apparently healthy, and there may be no evidence of a present or past mal-nutrition; but inquiry will generally elicit some past illness or salubrious dyspepsia, or a history of improper feeding, or some conditions which have tended to produce a mal-assimilation or imperfect digestion of the food. The deformities produced by rickets may continue to be present long after the acute stage has passed away.

If it be granted, as we think it must be, that a failure on the part of the alimentary system to supply the rapidly growing body with suitable nutrient material is an important factor in producing rickets, there is yet much left to explain, inasmuch as atrophy and tuberculosis and all wasting diseases of infants owe a similar cause. Why, for instance, should a chronic intestinal catarrh lead on to rickets in one case, tuberculosis in another, gastro-intestinal atrophy in another, and final recovery occur in another? If rickets

is produced by mal-assimilation, what are the steps in the process, or in what elements are the nutritive fluids wanting? These are questions that we think cannot be satisfactorily answered, and all we can attempt to do will be to discuss some of the influences which predispose or excite to rickets.

Hereditary Influence.—Is rickets hereditary? Do parents who have suffered from rickets in their childhood have rickety children, in the same way that phthisical parents have children who readily become tubercular? One great difficulty in answering this question is that it is impossible in a large majority of cases to be able to satisfy oneself, in the absence of any rickety deformities, whether the parents in any given case suffered from rickets when they were children or not, as they are hardly likely to know themselves, and a trustworthy history of their infancy is often not obtainable. Moreover, most infants suffer more or less from dyspepsia or have been exposed to conditions which may produce rickets; it is not easy to exclude such, and to say, dogmatically, that a rickety child must have inherited the tendency to this disease. Thus children who have been brought up at the breast of a healthy mother, and who are themselves fat and apparently strong, will sometimes exhibit beaded ribs and other evidences of rickets during their first year, which may be due to the mother's milk being thin and of an inferior quality, being deficient in fat and casein. In some cases, however, observed by Pfeiffer, who analysed the breast milk in eight such cases, this was not so, for in these there was no deviation from the normal amount of casein, fat, sugar, and salts; but there was a deficiency of phosphorus in the ash. Pfeiffer believes that the tendency to rickets is hereditary and acts as a predisposing cause, whilst a deficiency, for some reason or other, of phosphates in the breast milk acts as an exciting cause.¹ While the observations are curious and interesting, we believe that in the immense majority of cases where nurslings become rickety it is because the mother's milk is poor, or it is of improper quality from her having taken little care in the matter of her own diet, and the infant has suffered more or less from intestinal catarrh in consequence. The breast milk of a weakly woman, especially at the end of the natural period of lactation, is certain to be poor in fat, while the milk sugar is present in abundance, and the nursing may be fat and yet weak and rickety. See case p. 41.

While we do not believe that it has been satisfactorily shown that a tendency to rickets is hereditary, in the same sense that a tendency to gout or tubercle is hereditary, yet we are far from denying that hereditary influence plays some part in predisposing to rickets. We believe that if either father or mother, especially the latter, is weakly from any cause, their children will be more likely to suffer from rickets. A woman does much manual labour during her pregnancy, more than her strength will really admit of, or she lives under unhealthy conditions: the infant is weakly, is difficult to rear, and becomes rickety; we can hardly doubt that the influence of the mother's health has predisposed to rickets, or at least to the digestive troubles which precede rickets. We feel certain that weakly or premature infants may become rickety, even though the greatest pains and care have been bestowed on their feeding and bringing up. The fact that rickets may appear during intra-uterine life and the infant be born with beaded ribs and other symptoms of

¹ *Arch. f. Kinderh.* xvi. 1881, p. 11.

rickets shows that rickets can be produced apart from any improper feeding, and suggests that the influence of the mother's health during pregnancy may be an important factor in predisposing to the disease.

The influence of the mother's health in producing rickets is seen in large families, where the later children born are apt to be rickety. It happens also at times that first-born children are rickety, especially in those cases where the mother is very young.

Does syphilis in the parents predispose to rickets in the infant? Parrot asserted that rickets was the result of the syphilitic poison—that the latter when worn out or weakened produced rickets. Very few, even among his own countrymen, have accepted his views. Among the foundlings of Paris, and other large cities where syphilis is a common disease, it may be difficult or impossible to say exactly what influence syphilis exerts in producing rickets; in country districts, where syphilis is uncommon and rickets common, it is clearly seen that there is no connection between the two, or only that the syphilitic poison has a depressing influence on the system and so predisposes to rickets as it appears to do in tuberculous.

Nutritive Influence.—It has been stated that infants nursed at the breast of a healthy mother rarely become rickety, we may say never suffer from severe rickets; while infants who have been artificially fed from the first, and who have suffered much from dyspeptic affections, are nearly always affected. Infants who have suffered from diarrhoea, gastric catarrh, bronchitis, pneumonia, and especially those who have had a hard struggle for life, very frequently become rickety. Infants who were premature, and who have been reared with difficulty, are among those who often suffer. Infants badly fed, and those who from ignorance or necessity have been deprived of fresh milk and given large quantities of food in which starch has taken the place of fat are exceedingly likely to suffer from rickets. That improper feeding plays an important part in the production of rickets has been shown in the rearing of the young lions at the Zoological Gardens, and in the feeding of puppies and other animals on lean meat. 'These animals developed rickets, but improved at once when given milk and pounded bones.' The same thing may be seen again and again among our dispensary patients; a marked improvement in the symptoms following their admission to hospital, where a more suitable diet is given than the one which they have been taking.

Now, while there cannot be a doubt that infants who have been given large quantities of sago, sopped bread, arrowroot, condensed milk of a poor quality, or one or more of the much advertised patent foods, early develop rickets, yet so also do some infants who have been brought up on fresh milk and water, milk and cream, and peptonised milk. The food may have been theoretically correct as far as quality goes, the child may have been well looked after, and the parents or friends are surprised at being told that it has developed more or less of rickets. But children who thus become rickety though brought up on fresh or sterilised milk have almost certainly suffered a good deal from gastric or intestinal catarrh, and their food has failed to be digested and assimilated. It is no uncommon thing to find a child of eight or nine months, markedly rickety, being fed with far more milk than it can possibly digest, passing hard, pasty stools, and suffering from

1 See Chassin, 'Rickets,' Brit. Med. Assoc. Meeting, 1888.

flatulence and colic. A food in which starch or sugar has replaced fat, or which in other ways differs from human milk, will be only too likely to give rise to rickets; but the food may have contained fat in normal quantities and been otherwise suitable, yet if the child suffers from chronic dyspepsia, and the milk food has undergone excessive lactic or butyric fermentation in the alimentary canal, and consequently failed to nourish, the child is likely to be rickety, and it may suffer laryngismus and convulsions. We must not forget that the food itself may have been suitable, but the child may have been over-fed and a dyspepsia started which has passed into a chronic stage.

Hygienic and Climatic Influence.—The children of the well-to-do classes suffer less from rickets than those of the poor, and when they are affected it is in a milder degree; the same may be said of country children as compared with the denizens of the slums of our great cities. Rickets is more common in damp cold climates than in warmer ones. From these facts we gather that bad ventilation, and absence of fresh air and sunlight, are factors in producing rickets. That this influence is exerted through the digestive organs is very probable.

From the above remarks it is clear that we believe there are several factors in the production of rickets. Hereditary weakness, feebleness of the digestive powers, improper food, breathing vitiated air, exposure to cold and damp, will together, in some instances perhaps singly, produce rickets. Rickets abounds wherever the lower classes of the population are crowded together in courts and slums, where the mothers, from necessity or otherwise, are unable to suckle their infants, where fresh cow's milk is dear and of poor quality, and infant life is exposed to the various bad influences which poverty and ignorance are certain to produce. Rickets is a rare disease where the parents are strong and healthy, the mother able to nurse her infants, while taking care of her own health and diet, and where she is able to devote her whole time to the care and nurture of her offspring.

Chemical Theories.—The older authors attributed rickets to the absence, or diminished quantities, of lime salts in the food, but very little observation was sufficient to disprove this. Others (Seezan) have supposed a deficiency of hydrochloric acid in the gastric juice, and that consequently the lime salts, instead of entering the blood, passed through the alimentary canal. Some have thought there was a deficiency of phosphoric acid or phosphates in the food, and that its absence from the blood prevented the formation of bone. The 'acid theory' has also had supporters, who supposed there was an excess of lactic acid in the blood, which had been formed from the decomposition of milk in the stomach—the presence of the lactic acid dissolving the lime salts of the bones and carrying them out of the body in the urine. We confess to being completely sceptical concerning all these hypotheses, and much doubt if they explain anything as to the pathogenesis of rickets. We certainly think that an amount of both fat and phosphates in the food below the normal may be one factor in producing rickets.

Symptoms and Course.—The precursory or early symptoms of rickets may be absent, or so intermingled with those of dyspepsia that it may be impossible to differentiate them. In the slightest grades of rickets the first and perhaps the only signs of the affection are slightly beaded ribs and enlarged epiphyses at the lower ends of the radius and ulna. In the more severe forms

of the disease the early symptoms are slight fever, the infant being hot and restless during sleep; abundant perspiration, more especially about the forehead and scalp, may then be noticed; at this time the infant may suffer from convulsions and not infrequently laryngismus. His bones may be more or less tender, so that he cries on being moved or danced about in the nurse's arms, and usually some swelling of the ribs can be detected. In the majority of cases the abdomen is habitually distended with wind, and there is mostly constipation, though, on the other hand, the stools may be loose and curdy. The child may be anæmic and the spleen may be felt to be enlarged.

As time goes on it is noted that there is a delay in the appearance of the teeth; if the first two incisors have been cut, a long interval, perhaps many months, elapses before the appearance of the others, and the teeth that have been cut are apt to become carious, from a deficiency in their enamel. The muscular system is almost certain to suffer, the child cannot sit up from weakness of the *latissimus* muscles, and the spine bows out from laxity of the ligaments; the infant does not use its limbs like a healthy child, making no, or poor, attempts at crawling; its legs are weak, it cannot bear its weight on them or even put them to the ground.

Concurrently with many of these phenomena, marked changes are noted in the bony skeleton. The skull early shows these changes, though, if rickets does not supervene till the middle or end of the second year, the bones of the skull may escape. There is a marked exaggeration of the frontal and parietal eminences, with some flattening of the upper surface, so that there is a sort of table-land at the vertex, the head assuming a more or less quadrate shape. Sometimes there is flattening of the occipital bone behind, so that the back of the head looks as if pressed in. In severe cases there are broad shallow grooves corresponding with the sagittal and coronal sutures, and consequently running at right angles with one another. The fontanelles are widely open and may remain so long after they should be closing up, and the edges of the bones where they come together to form the sagittal, coronal, and lambdoidal sutures are thickened. Instead of, or in combination with, these hypertrophic changes at the eminences and edges of the bones, there may be atrophy or thinning of the central parts of the occipital or parietal bones, which has been termed *crania-tabes*. These weak places can be felt by gentle pressure exerted with the finger on the occipital or parietal bones, of course avoiding the sutures, the bone perhaps breaking and bowing in almost like parchment beneath the finger. It has been questioned to what extent *crania-tabes* is the result of rickets, as it is present at times in undoubtedly syphilitic children, and also in those suffering from various wasting diseases. We doubt whether its correction with syphilis is anything more than a causal one, but it is certain *crania-tabes* may be detected in weakly infants a few months old who exhibit no other signs of rickets, and also in newly born infants. Whether it is always to be accepted as pathognomonic of commencing rickets is an open question, but when present in infants over six or eight months of age it is almost always in our experience accompanied by signs of established rickets.

Characteristic changes take place in the chondral ends of the ribs and in the shape of the chest, the latter being most marked in children who suffer from bronchitis. The ribs are enlarged or beaded where they join their

cartilages: these may be felt or seen at a glance when the chest is exposed. The shape of the chest-walls is altered in consequence of the softening of the costal ends of the ribs; the rigidity of the chest-walls is impaired at this spot, so that there is a falling in of the ribs on each side, while the sternum and cartilages are thrust forward (see fig. 64). The sides of the chest, especially the region included between the fourth and eighth ribs, bend or curve inward so that a more or less broad vertical groove is formed on each side of the chest. The angles of the ribs are often exaggerated or undergo a sharp bending or 'kink' at this spot. With these changes is usually associated a widening of the arch which the ribs make inferiorly, and the abdomen is distended and veined. If the child be watched, especially if there is any bronchial catarrh, the chest walls will be noticed to fall in at the grooves on

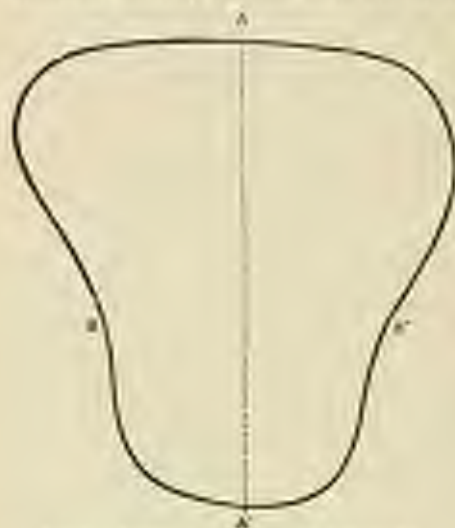


Fig. 64. - Drawing of Chest Wall of a Tubercle Boy of two years of age.



Fig. 65. - Enlargement of Epiphyses of Lower End of Radius and Ulna of child of eighteen months.

each side, and the tip of the sternum is drawn in during inspiration. All degrees of chest deformity may be present, from the extreme degree noted above, to a slight prominence or keel-like ridge in front, formed by the sternum, which makes what is called the 'pigeon-breast.' The clavicle often joins in the deformity, its normal double curve being exaggerated. The extremities show peculiar changes, more especially at the lower epiphyses of the radius and ulna, and the tibia; the shafts are very apt to bend and in the worst cases may fracture. The lower ends of the radius and ulna are swollen, the swollen portion involving the irregular layer of cartilage, in which calcification is proceeding (see fig. 67), which separates the cartilage of the epiphyses from the shaft; in the worst cases this enlargement is very striking (see figs. 66 and 67). The tibia is usually more or less bent, the curve varying in position and degree; the lower end is, however, most commonly bent inward (being an

exaggeration of the natural curve), so that the convexity is outward (see fig. 70 of text), a deformity which is produced by the child whilst sitting on the floor, with its legs crossed under it, and shuffling with its legs so as to change its position. The deformity often takes place before the child learns to walk. The deformity known as 'knock-knees' is produced later, after the child has begun to walk (see fig. 73). The other long bones, the femur (see fig. 70 of text), radius and ulna, and the humerus, are apt to bend. The bowed humerus is sometimes produced by the attendants lifting the child by grasping its arms, just below the shoulder. If the child can sit up the spine is apt to become bowed, an exaggeration of the natural curve taking place in the cervical region, while the dorsal curve is exaggerated and involves the lumbar, so that the spine bows out backwards, a result largely due to the weakening of the ligaments (see fig. 74).

It must not be supposed that all the changes in the shape of the bones take place in any one case, and the degree of deformity differs according to the severity of the case. As before remarked, the shape of the head may be quite normal, and only the epiphyseal swelling and deformity be noted in the ribs and fore-arms. Sometimes muscular weakness is the symptom which most strikes the friends: the child is dyspeptic; has a rounded belly and pale face, the teeth are late in appearing; the child, who is perhaps eighteen months or two years old, cannot stand or walk, and medical advice is sought because the parents think the legs are paralysed; or the child is brought to a doctor, as it is supposed he has spinal disease, on account of the bowing backwards of the spine; or the pigeon-breast is the most marked and striking symptom which alarms the friends.

The phenomena noted in connection with the nervous system in rickets are among the most important. The whole nervous system appears to be affected, the nerve centres are in an unstable condition and readily discharge on the slightest provocation. General convulsions are common, more especially during the early stages of the disease; they vary much in their severity, sometimes being slight and passing away quickly, but, on the other hand, it is no uncommon thing for a rickety child of a year, eighteen months, or two years to die in a few minutes in a fit. Laryngismus is common, and indeed is almost confined to those who are rickety. Tetany is also common in rickety children. A hypertrophic condition of the brain, with a large head, is not uncommon. Rickety children are exceedingly liable to bronchial catarrh and broncho-pneumonia, and in these all chest troubles are apt to be serious. They are liable also to suffer from dyspeptic troubles, especially diarrhoea.

In the severest form of rickets the child is apt to become markedly



Fig. 75.—Section through Radius of case figured in fig. 66, showing exaggerated depth and irregular borders of the epiphysis and columnar bones of lamellae.

anterior, and when this is so there is usually enlargement of the spleen. It has been doubted if splenic enlargement is present in uncomplicated rickets, or in those cases only which are combined with syphilis. We certainly have seen cases where the spleen was enlarged, where no history of syphilis could be obtained. With enlargement of the spleen there is frequently a marked enlargement of the liver.

The course of rickets is towards recovery, but progress is frequently very slow, especially in those cases where there is chronic derangement of the digestive organs. The child is certain to be late in walking; instead of 'kicking his feet' by the end of the first year, he is utterly helpless when his legs are put to the ground, and at the end of the second or even the third year, rickety children may be seen who are quite unable to bear their own weight on their legs. All this time, perhaps, the child is incapable of much exertion and is easily tired. Many dangers attend rickets on account of the weakly state of the child. He is especially liable to catch cold; this may be followed by bronchitis and broncho-pneumonia. The latter is necessarily dangerous on account of the weakness of the ribs and feebleness of the respiratory muscles.

Bronchitis and collapse of lung, or broncho-pneumonia, is exceedingly apt to be fatal when it complicates rickets. One of the effects of rickets is to stunt the child's growth, as well as to leave him with many deformities, which will be discussed in detail later on. The lowering of the child's health produced by rickets may last for many years, but in the vast majority of cases the symptoms and signs of rickets, if they come under treatment, disappear, and the child may grow up into a healthy adult.

Pearly Rickets.—*Congenital Rickets.*—In rare cases children are born with deformed bones, enlarged epiphyses, and beaded ribs—a condition to which the name of rickets can hardly be derived. Other cases have been observed in which the bones have been soft and deformed, but which lacked the characteristics—both naked-eye and microscopic—of rickets. Hence some confusion has arisen, and the terms *infantile osteomalacia* and *prolimum* have been applied, as it was thought they resembled these rather than rickets. There can hardly be a doubt, however, that children are born rickety, or that they become so very shortly after birth. Such cases have been observed by Bodo,¹ T. Barlow,² and the late Dr. Marshall (of Preston). In Bodo's case the infant was stillborn, the mother was healthy. The infant's head was hydrocephalic, the limbs were short and bent, the chest deformed, and the ribs beaded; the pelvis was narrow. The microscopic examination showed changes resembling those found in rickets. In Dr. Barlow's case there was a history of the infant being born with deformed limbs, which were also tender, and when seen at six weeks old the long bones and ribs were typically rickety, and there was a green stick fracture of the humerus. Dr. Marshall's case was somewhat similar. (See *Cremism*.)

There are several morbid conditions found in children under two years of age which are invariably associated with rickets, though there may be some doubt as to what relation there is between rickets and these morbid states. We refer to the so-called 'acute rickets' and *Anæmia splenica* or *Anæmia pseudo-leucæmia infantum*. In the former there is a hemorrhagic diathesis usually associated with acute rickets, and in the latter there is pro-

¹ Virchow's *Archiv.* 39, Heft 10.

² *Clin. Soc. Trans.* vol. viii.

fatal anemia with enlarged spleen also associated with rickets. We have discussed the latter already; see p. 364.

Scurvy Rickets, Hemorrhagic Rickets, Infantile Scurvy.—Dr. W. D. Cheadle was the first in this country, at least, to recognize this condition, which he described as a combination of scurvy and rickets; and Dr. T. Earle has largely added to our knowledge of the morbid anatomy of this peculiar disease by his admirable descriptions of a series of cases with *post-mortem*.

The first difficulty which meets us in describing this condition is the impossibility of separating clinically cases of acute rickets from cases of 'scurvy.' There are 'borderland' cases, as Dr. Earle would call them, which shade away clinically into acute rickets on the one hand, and rickets plus a well-marked hemorrhagic diathesis on the other. Thus we may not infrequently meet with a child of say eight or nine months of age who has been badly fed, and who has well-marked tenderness of the bones, and cries whenever he is moved, with also head perspiration and more or less indigestion. There may be no external evidence of any hemorrhage to suggest scurvy, and yet the child at once improves when its diet is changed in the direction of giving it fresh milk, cod liver oil, and orange juice. Perhaps in a similar case to the above there is hematemia in slight degree, or the gums are hemorrhagic around a tooth that is being cut, the case is now called one of scurvy rickets. Now there appears to us to be no doubt that these cases are closely associated, and that they cannot be separated. There is the strongest probability that in rickets in its early or acute stage or in severe cases there is a tendency to hemorrhage, that minute bleedings take place from the most vascular parts, such as the periosteum of the long bones, especially if there is an injury. In one case coming under our notice, that died of an intercurrent disease, we were surprised to find minute bleedings had taken place along the epiphyseal lines of the long bones and ribs.

In a typical case of scurvy rickets in an early stage where a hemorrhage has taken place beneath the periosteum of the tibia or both legs, the most characteristic symptom is a loss of power and tenderness of the lower limbs. The child cries when it is disturbed, and especially at the approach of a stranger. The legs hang down as if completely paralyzed, though the child can usually draw them up, flexing the knees and hips. The skin is tense and shining over the shin and the dorsum of the feet are oedematous. In cases such as the above the bleedings are probably small and numerous. There is also more or less peritonitis as the temperature is often raised a degree or two. In several cases we have noted a local thickening of the knee on recovery. An examination of the mouth will almost certainly show that the gums are hemorrhagic around any teeth that have been cut or are about to be cut. The napkin may be stained red by blood which is coming from the urinary tract.

Should the case be more advanced or more severe, there is always marked anemia which strikes the observer at once. There may be evidence of a considerable hemorrhage beneath the periosteum of the tibia or femur, there may be much swelling and oedema as well as pain and tenderness. Bleeding may take place from the periosteum of the bones of the upper limb,

skull, scapula, and ribs. A violent fit of crying may have given rise to a bleeding beneath the pericranium of the orbital plate, and the eye is consequently pressed downwards and the upper eyelid is everted. The gums are hemorrhagic, and swollen, and spongy, and the breath foul. There may be hæmatomas beneath the skin and in or between the muscles. Purpuric spots and bruise marks, the result of slight injury, are often present. Hemorrhagia is common (see Hemorrhagia), blood in the stools is less common. In severe cases it is well to bear in mind the possibility of an internal hæmorrhage either into the lungs or beneath the dura mater (Sakelund). In a few cases fractures of the bones have been reported, the common position being on the diaphysial side of the growing bone. An examination in all these cases will show, as far as our experience goes, that there is well marked rickets. Bones are present on the ribs, the skull is more or less moulded, and perhaps the epiphyses of the long bones are enlarged.

It is curious how in most cases there is evidence of a pericranial lesion, either there is a swelling and the skin is shiny and tense, or there is marked tenderness with or without pain on movement. Rickets bone is very vascular, and this is especially true of the bone being formed beneath the pericranium. In a few cases we have seen anæmic rickets children pass blood in their urine without any bone tenderness or swelling, and in one case a child of fourteen months who was anæmic and had been exceedingly difficult to feed, passed a considerable quantity of blood in his stools, commencing when, staying away at the seaside in apparent health, though he was certainly anæmic. He never had spongy gums but he readily bled from cracks in his lips. He gradually improved apparently as the result of the meat juice being added to his food. He had lived principally on a mixed food made with fresh milk, though he had taken scraps of various kinds from his parents' table.

An inquiry into the food which the child has taken will almost certainly show that the diet has been faulty, and in a large proportion of the cases the child has suffered from vomiting or diarrhoea, or at any rate severe and continued dyspepsia. In some cases it was evident that the most careful care had been exercised, or the child would never have survived. The common history which has been given in our own cases was that the child had been nursed at the breast for awhile and then this for various reasons had been given up. Then some form of fresh milk had been tried, but this also had been given up in consequence of vomiting or colic. Then some patent food or condensed milk had been substituted, and this had been continued up to the time of the onset of the symptoms. In ten of our cases this substitution had been peptonised milk, either tinned or made fresh from cow's milk. It has been our experience, and this has also been the experience of others, that a continuance for some months of peptonised foods, although made from fresh cow's milk, has appeared to give rise to a hæmorrhagic diathesis. In three of our cases tinned milk had been used exclusively for some time before the onset of symptoms. In one of our cases the sterilised milk of a well-known dairy company had been used. In seven cases fresh milk made with some farinaceous food or malted food had been used, the milk having been boiled in preparing the food. In several of our cases raw meat juice, and in one case a raw egg, and in another potatoes were

being given when the symptoms developed. There cannot be any doubt, whatever view we may take of the pathology of these cases, that they are the result in large measure at any rate of a long continuance of peptonised milk, or of some farinaceous or starchy food as an article of diet. That these symptoms may also be produced by fresh boiled milk is, we think, also certain, and in occasional cases when raw beef juice, raw eggs, and potatoes form part of the diet. The fact that we have met with cases of 'scurvy-rickets' affecting children who have taken fair quantities of fresh boiled milk and in some cases raw meat and even potatoes, has made us have some misgivings as to whether these cases were instances of classical scurvy. We entertain no doubt, however, that a hæmorrhagic diathesis is set up by a long exclusive use of peptonised foods or dried malted milk.

Meekid Anasarca.—The most striking appearances in connection with rickets consist in the changes in the bones. In the first place, chemical analysis shows there is a deficiency of lime salts in their constitution, and an excess of organic matters. Normally they contain, roughly, 65 per cent. of inorganic constituents and 35 per cent. of animal matters; in rickets, all degrees of decrease of inorganic matters may take place, but in a severe and well-marked case the proportions are reversed, so that there is only about 35 per cent. of mineral basis and 65 per cent. of gelatinous or organic matters (A. Baginsky). That there is a deficiency in calcium salts is evident from the spongy nature of the bone, its softness, and the readiness with which it 'bends'; while the spaces between the bony trabeculae are seen to be filled with juicy material. If a rib taken from a well-marked case of rickets during the acute stage be examined, it will be found not only to be wanting in rigidity, but it can be bent about like a thin lath, and, if doubled up, fractures or 'gives' with the greatest ease; the fracture may be only partial, or perhaps the ends of the bones are only held together by the fibrous and muscular tissues attached to them. In the same way the fore-arm of the cadaver may perhaps be bent by taking it in the two hands and applying moderate force, or it may 'kick,' and on dissection both radius and ulna will be found to be fractured. Other long bones may behave in a similar way if sufficient force is applied. The ribs, where they join the cartilages, will be noted to be much swollen; fractures, recent and old, may be present at the angles of the ribs, and the lower ends of the radius and ulna where they join the epiphyses. A section can readily be made with a strong knife through the enlarged end of the rib, and if made in a direction from before backwards it will be seen in most cases that the pleural side is more prominent than the external side of the swelling, and, moreover, the enlargement is produced by the expansion of that portion of cartilage—the proliferation and columnar zones—in which certain changes are going on preparatory to the deposition of lime salts in the matrix of the cartilage. If a comparison be made with the end of a healthy child's rib, it will be seen in the latter that between the cartilage of the rib, which is yellowish and opaque, and the cancellous tissue of the rib, there is a line of translucent and bluish cartilage, about $\frac{1}{4}$ inch in breadth at birth, and about $\frac{1}{2}$ inch at a year or eighteen months old (Kassowitz); this line is perfectly regular and straight; the breadth of it depends upon the rapidity with which growth is going on, which is greater during the later months of fetal life and those immediately succeeding birth than it is later. In rickets the

activity of these preparatory changes in cartilage is enormously increased, so that the multiplication of cartilage cells takes place with great vigidity, and with this there is a softening of the cartilage and matrix, and a consequent increase in size of the proliferation and columnar zones, so that the translucent line seen in normally growing bone is increased in breadth to perhaps $\frac{1}{2}$ inch or more, and there is a bulging or swelling in this position which is visible through the skin of the chest wall, and corresponds to



Fig. 55. Longitudinal section through the junction of a rib and its cartilage, from a Ribbery child of two years. A, junction of rib and cartilage; B, epiphyseal zone; C, proliferation zone; D, columnar zone; E, depth and breadth zone; F, depth of junction; G, junction; H, junction; I, junction; J, junction; K, junction; L, junction; M, junction; N, junction; O, junction; P, junction; Q, junction; R, junction; S, junction; T, junction; U, junction; V, junction; W, junction; X, junction; Y, junction; Z, junction; aa, junction; bb, junction; cc, junction; dd, junction; ee, junction; ff, junction; gg, junction; hh, junction; ii, junction; jj, junction; kk, junction; ll, junction; mm, junction; nn, junction; oo, junction; pp, junction; qq, junction; rr, junction; ss, junction; tt, junction; uu, junction; vv, junction; ww, junction; xx, junction; yy, junction; zz, junction; aaa, junction; bbb, junction; ccc, junction; ddd, junction; eee, junction; fff, junction; ggg, junction; hhh, junction; iii, junction; jjj, junction; kkk, junction; lll, junction; mmm, junction; nnn, junction; ooo, junction; ppp, junction; qqq, junction; rrr, junction; sss, junction; ttt, junction; uuu, junction; vvv, junction; www, junction; xxx, junction; yyy, junction; zzz, junction; aaa, junction; bbb, junction; ccc, junction; ddd, junction; eee, junction; fff, junction; ggg, junction; hhh, junction; iii, junction; jjj, junction; kkk, junction; lll, junction; mmm, junction; nnn, junction; ooo, junction; ppp, junction; qqq, junction; rrr, junction; sss, junction; ttt, junction; uuu, junction; vvv, junction; www, junction; xxx, junction; yyy, junction; zzz, junction.

the junction of the ends of the ribs with their cartilages (see fig. 55). Not only does this normal line become a broad band of jellylike material interposed between the cartilage and bone, but the boundary between it and the cancellous tissue is very irregular and ill-defined, inasmuch as an irregular calcification of the matrix is going on, and trabeculae of calcified material with wide medullary spaces are being formed instead of true cancellous tissue. A spongy structure is built up which is wanting in strength and rigidity. Similar changes are going on beneath the periosteum: there is a calcification of the inner layer, and spongy bone is built up instead of the firm, hard, compact tissue which forms the outer shell of healthy bone (see fig. 56). It is clear that if the compact hard bone which forms the shaft of the bone is replaced by trabeculae or arches of brittle, badly formed bone, the bone will readily bend and snap, and be simply held together by the fibrous periosteum and perhaps some of the fluid

material which forms in the substance of the bone itself. The bones may remain soft and brittle for many months, but finally they harden, perhaps in a faulty position, and a sort of sclerosis or ossification of bone takes place, so that the compact tissue of the bone is abnormally hard. Should a fracture take place there is a large amount of callus formed at the seat of fracture. In acute cases, or in those in which the hemorrhagic diathesis is present, bleedings large or small may be found beneath the periosteum and along the line of junction between the epiphysis and the shaft.

The bones of the skull are abnormally soft and can be easily cut with a

bone, and are much more readily bent or doubled up than are healthy bones. Their edges are thickened and spongy on section, much juicy-looking, fold ending; the ossifying centres are usually thickened, so that the frontal and parietal eminences are exaggerated. In some cases prominences or bosses may be present on the parietal or frontal bones, near the sutures; but it has been denied that these are really rickety changes, though they certainly do occur in rickety subjects. Instead of, or in association with, the hypertrophic changes just referred to, certain atrophic changes take place, the bone becoming thin, almost transparent, in places; this thinning of the bone is chiefly present in the parietal and occipital bones. If the dura mater be stripped off and the bone held up to the light, it will be seen to be thin in places, perhaps almost as thin as parchment; at these spots it readily yields to the pressure of the finger, bending in under the slightest force. Rickety skulls are usually large ones, not only that they look large in consequence of the thickness of the prominences on the parietal and frontal bones, but their capacity is increased, the brain being larger than usual; it is possibly the pressure of the brain within that causes the atrophic changes in the bone.

The changes found in the internal organs are not usually very marked unless death has taken place, as it not infrequently does, from bronchopneumonia; then varying degrees of bronchitis, pneumonia, and collapse of lung are present. The brain is frequently found of large size, the convolutions well-marked, the substance fairly firm; such brains are said to contain an excess of the neuroglia elements. The liver and spleen are usually enlarged and firm, and the former on section has a 'gummy' or more or less mamillated appearance. Concerning the blood but few observations have been made. Dr. Goodhart has observed in some of his cases a deficiency of corpuscles, in some deficiency of colouring matters, in some the blood crowded with a granular detritus, and in others the corpuscles were of four or five different sizes.

The most recent examinations of the blood in rickets have been made by Feilerthal, who examined the blood in twelve cases of rickets, varying in age from six months to two years. He found the number of red blood corpuscles nearly normal, but the haemoglobin diminished (40 to 50 per cent.—Fleischel), the number of white corpuscles was increased two to five times. In severe cases some of the red corpuscles were nucleated.



Fig. 34.—Transverse section through the skull of the Ulna from a Malnourished Child of thirteen months. (J. W. Kossowitz.) Showing spongy tissue beneath the periosteum instead of the compact inner table of normal bone.

Treatment.—If rickets is due to the mal-assimilation of the products of digestion or to faulty digestive processes, we can hardly hope to discover any specific for its cure, but must direct all our efforts to secure that suitable nourishment in appropriate quantities is taken, and that the digestive apparatus shall be in good working order. Directly the first symptoms make their appearance, whether they are tenderness of the bones, swelling about the head, or enlarged epiphyses, spongy gums, hæmaturia, we should carefully inquire into the diet, as it is probable that the child is either indigesting its food properly, or it is not being properly fed. The condition of the digestive organs and the state of the blood act and react on each other, the intestinal juices are weak because the blood from which they derive the materials to form their secretions is weak and poor in quality, and the blood remains of poor quality because the digestive juices are feeble and unable to convert albumen into peptones, and supply the first step towards converting the food taken into blood. The child suffering from rickets in the acute stages requires albumen and fatty foods in the most easily digested forms, such as cream, whey, raw meat juice, while all forms of peptonised or tinned foods should be avoided. Probably it will be found that a child so affected is suffering from dyspepsia, the abdomen is large and distended with gases given off during intestinal digestion, while large masses of undigested food are being passed. The treatment must be commenced by cutting down the supply of curd of milk, by diluting it largely with whey or barley water. In the worst cases milk may have to be withdrawn entirely for a while, and raw or semi-cooked meat juice, with barley water, substituted. In other children pounded raw meat may be given. Dextrin and maltose in any form are preferable to sugar in excess or starches. Cream in small quantity will often agree, though fat in the form of cod liver oil is often more readily digested than any other form. A well-made emulsion may be given at any time, beginning, if there is much digestive disturbance, with a few drops only, care being taken not to give an excessive quantity. Orange, lemon, grape juice or apple juice should be given in all cases where there is a tendency to hæmorrhage. Potato pulp is useful in the same condition.

The importance of fresh air, especially sea air, in the treatment of rickets, cannot be over-estimated, and when the disease first declares itself a change to the seaside or into the country if the weather is warm enough is likely to be attended with the greatest benefit. In urging the friends to send the child out into the open air the tendency which rickets children have to bronchitis must not be forgotten, and the importance of warm woollen garments must be insisted on; especially is this important where there is much sweating. If the weather is cool, the child's feet should be carefully strapped up while he is out in his carriage; a bottle of hot water in his feet will often prevent a chill.

The most careful handling must be practised in acute cases, as the bones easily fracture or a hæmorrhage may take place. The prone position on soft cushions in a cot or carriage is better than such sitting in the arms, as the limbs are easily bent and the spine bows out if the child is allowed to sit up much.

Of medicines, the most important are those which assist digestion or correct the faulty condition of the mucous membrane of the stomach and

bowels, and those which aid nutrition and improve the character of the blood. Vomiting, constipation, dyspepsia, and diarrhoea must be treated by appropriate medicines: small doses of mercury and chalk, saltpetre and soda, pepsine or bismuth: care should always be taken to overcome the constipation so often present. Of tonics, cod-liver oil, esterase, or cod liver oil in combination with malt extract, is by far the most important, though in practice it is common to find it is being given in excessive quantities and at a time when the digestion is weakened. In such cases it may be given by fraction. Phosphate of soda with tartrate of iron and glycerine is a useful tonic, assisting the action of the bowels and combating the anaemia so often present. Iodide of iron is also useful.

Small doses of phosphorus have been given by Kossowitz, Wegner, and A. Jacoby, who claim for it an almost specific action. Other physicians have been disappointed with the results obtained by its administration. It may be given in doses of $\frac{1}{2}$ gr. to $\frac{1}{4}$ gr. in cod liver oil, two or three times a day.

Rickety Deformities.—Distortions of the lower limbs as a result of rickets form a large and important group of the deformities of childhood. Most commonly all the long bones of the limb are affected, and there may or may not be distortion of the articular surfaces at the knee. In many instances the deformity is limited, or at least most marked either in the shaft of the femur, the lower third of the tibia, or the lower end of the femur.

Curvature of the shaft of the **femur** takes place either with its convexity forwards or in severe cases forwards and outwards. There is then a wide space between the thighs, and the quadriceps stands out very prominently over the convexity of the bone: the patient is short and stooped-looking, the gait waddling, and there is knock-knee or bow-leg to a greater or less degree.

The whole of the shaft takes part in the curve, as is seen in fig. 70. In this child the deformity was extreme, and was accompanied by so much rotation of the lower end of the femur upon a vertical axis that the leg and foot faced directly outwards instead of forwards. In this case osteotomy was performed at the most convex part, and the limb turned round as well as straightened, so that ultimately the feet were natural in position (fig. 72). Sometimes the curve is limited to the lower end of the diaphysis.

Rickety deformities of the **upper limb** are seldom of such extent as to interfere with the perfect use of the arm or to require operative treatment. Obviously this is because no such strain is put upon the arms as upon the legs in childhood. It is rare for even the application of splints to be necessary, and we have hardly ever had occasion to straighten forcibly, never to osteotomise, a rickety deformity of the arms. The distortions are most commonly produced by the child crawling upon the hands, and consist chiefly in bendings of the shafts of the bones. We have, however, seen a condition analogous to *genu valgum*, but reversed—i.e. instead of the normal outward obliquity of the fore-arm in extension, it was directed inwards so that the convexity of the humerus was outwards at the elbow; this disappeared during flexion as in *genu valgum*, and was probably due to a similar bony condition, though we could not satisfy ourselves of the exact seat of deformity. A similar condition may occur as a result of separation of the lower epiphysis of the humerus and irregular union. In the humerus the deformity consists usually in curvature with the convexity outwards.



Fig. 76.—Back and Limbs of the Patient, caused by the deformity shown in the next figure.



Fig. 75.—Shows the spine habitually curved, &c. the child with is seated in the deformity shown in Fig. 76.



Fig. 74.—The same child shown in the last two figures. The limbs have been straightened by surgery.



Fig. 73.—A child, aged 2 years, showing extreme swelling from granular hydrops, as well as callosities & deformities, all the result of Rickets. The child could not stand alone.

The rickety deformities chiefly amenable to surgical treatment are those of the spine and limbs; distortions of the chest and pelvis can only be improved by general management of the health, and prevented from getting worse, though it is possible that gymnastics, directed especially to exercise the inspiratory muscles other than the diaphragm, and to increase the inspiratory capacity, may somewhat improve rickety chests. For the pelvis, even if the distortion is noticed before adult life, nothing can be done except to prevent the deformity from being increased.¹

The **rickety spine** is met with in two forms: in one there is a general curve convex backwards, *kyphosis* (fig. 74), affecting the whole dorso-lumbar region; in the other there is *lordosis* (fig. 75).

The first form is that met with in infants and young children before they begin to walk; the other variety is usually secondary to deformities of the lower limbs, and is therefore most frequently met with after the age of two years. Lateral curvature is considered later.

The **kyphotic rickety spine** is readily distinguished from other spinal curvatures by the age of the child, the evidence of rickets elsewhere, the extent of the curve, which is large and rounded, never acute or angular, and the flexibility of the spine, so that by laying the child flat or holding it horizontally by its arms and thighs, face downwards, the curve speedily disappears. Care must, of course, be taken in applying this test. Finally, there is no pain, except in some cases the general rickety tenderness, and no evidence of caries in the shape of abscess, paralysis, &c. The attitude of a child suffering from rickety spine is well seen in fig. 74 as compared with that in caries (figs. 135 and 137).

All that is required in this condition is the general treatment of the rickets and rousabancy, not implying by this that the child is to be kept in bed in a stuffy room, but that it is not to be kept sitting up on its nurse's lap, except for very short periods at a time. These means should be continued until the health is improved, and the spinal muscles strengthened by friction and salt-water bathing. A sheet of gum-percha or other material may be bandaged to the spine to keep it straight, if preferred, in the intervals of friction (Noble Smith). Unless neglected, the spine always straightens, and regains or rather develops its natural curves.



FIG. 74.—*Kyphotic Curvature of the Spine.*
The *Antropometrika* form.

¹ *Quæren*, quoted by Noble Smith, found pelvic deformity in only 13 cases out of 500 rickety patients, while Heyer found it in 210 cases out of 1000. Later deformities of the lower limbs are all secondary modifications in the shape of the osseous. His paper in the *Lancet*, August 6, 1880, should be read by those interested in the medical profession of deformities.

The lordosis of rickets may be mistaken for a secondary deformity due to hip disease, congenital dislocation of the hips, &c., but the absence of these conditions is readily made out, and other rickety deformities will be found present. Its appearance is seen in fig. 73, which may be compared with that of a case of congenital dislocation (fig. 157).

It should be remembered that lordosis always results from some cause tending to throw the upper part of the spine forward in standing, such as curves of the upper part of the column, stiffness of the hip joints, drooping of the legs, or undue weight in the upper part of the body or head: in very rare instances lordosis may result from curves of the spine directly, chiefly when the arches are the seat of disease: it is then due either to actual destruction of the arches or to muscular spasm. Lordosis combined with a lateral curve may result from unilateral deformity of the lower limb in

infantile paralysis, loss or shortening of one leg, &c.: all these possibilities should therefore be kept in mind before it is concluded that the condition is simply rickety.

As the lordosis is usually secondary, as already stated, to deformities of the legs, its treatment must be secondary to that of the limbs, and no special applications or apparatus are required.

Where it is compensatory to angular curvature, it is, of course, necessary, and does not admit of treatment.

Knock-knee.—Deformity of the lower end of the femur, resulting in knock-knee is *genu valgum*, occurs in several different ways besides the one already described. The inner part of the shaft of the epiphyseal line sometimes grows more rapidly than the outer (Micklethorpe); hence the inner



FIG. 74.—An ordinary case of Knock-knee.

half of the shaft is longer than the outer, the inner condyle descends lower, the line of the knee-joint becomes oblique, and the tibia is set at an oblique angle with the femur. This condition may be due to premature synostosis at the outer half of the growing line (Ollier and Trier), a condition found so often in rickets, and explaining largely the stunted form of extreme cases. (Figs. 73 and 75.) Sometimes the same results follow from absolute overgrowth of the inner half of the epiphysis and the internal condyle as compared with the outer. In other instances, dependent upon the irregular ossification characteristic of rickets, the outer condyle does not develop, and, though the inner half of the epiphysis is not absolutely larger than in health, it is so relatively to the aborted external part. Again, the soft, ill-developed rickety bone, though symmetrical at one time, actually wastes or is absorbed as the result of pressure, and a corresponding deformity results. No doubt in some of these children a yielding of soft, ill-formed ligaments is the primary condition, and the bony changes only occur as the result of the slight

obliquity produced by this yielding. The deformity is, however, sometimes congenital.

In explaining the cause of the particular kind of deformity it must be remembered, first, that the femur is normally set at an angle with the tibia and not vertically upon it; secondly, that these children often assume attitudes in which the weight of the body and limbs so presses upon certain parts of the shafts of the bones that they yield, and curves result. Such deformities are produced by habitually sitting cross-legged, as is seen in fig. 71, 6c. Other reasons are that in certain cases congenital inequality in length of the limbs throws the weight of the body both unequally and obliquely upon one leg;¹ and again, where the deformity has arisen before the age at which walking begins, the pressure of the nurse's arms and the leverage of the weight of the limbs themselves acting over the nurse's arms may produce deviation. Congenital or acquired valgus, slight degrees of infantile paralysis, or any cause tending to throw the weight out of the normal line, will in some instances prove the starting point. In all cases it is clear that, as the bones are soft and tenderly yielding, a pressure that would have no effect upon a healthy bone will cause deviation in a rickety child, and that, when once the curve is started, it will always tend to increase more rapidly.

It is not impossible that the irregular ossification of rickets pervades the normal architecture of the bone from being built up and so weakens it—i.e. the special arrangement of arches and struts in the cancellous tissue—is not preserved.

Sometimes knock-knee is due to distortion of the tibia rather than the femur, and it will usually be found that the upper tibial articular surfaces are misshapen and bevelled off. This is, however, generally a secondary condition.²

Bow-leg, *genu varum* or *genu extrovarum*, is a deformity which, though dependent upon the same general causes as knock-knee, differs from it in most instances in its mechanical causes; thus it is rarely dependent upon a local inequality of growth in the lower end of the femur, but is usually a general as opposed to a local curve of both femur and tibia, and is not limited to the region of the knee. It is more commonly found in one leg, the other being the subject of knock-knee, and in such cases it will nearly always be found that the knock-knee has appeared first and the bow-leg later; in fact, the bow-leg is the result of the knock-knee. If such a patient is stripped, it will be found that the axis of the trunk is directed from one shoulder obliquely downwards to the hip of the knock-kneed limb; then the line of pressure, following the axis of the thigh of that side if produced, would pass through the region of the opposite knee; hence yielding to this pressure produces an outward bowing of the whole of the opposite limb. It is true that the curve of bow-leg is not quite even, and is usually sharpest at the weakest part of the leg—the lower third of the tibia; much more rarely there is a true *genu varum*, or bowing out, mainly at the knee itself; in such cases the head of the shaft is usually very prominent.

Double *genu valgum* occurs when the changes in both legs begin at the same time and go on at the same rate; double bow-leg results either from

¹ Rivers has laid stress strongly upon this fact.

² Noble Smith believes it to be a main cause of knock-knee.

local changes exactly opposite to those of knock-knee, or, more often, is started by the position assumed in sitting by the child, and increased by the weight of the body subsequently. Thus it is common to see children sitting on the floor with both thighs somewhat abducted and rotated outwards; in this position the limbs rest on the hips and ankles, and the knees are quite unsupported. The weight of the limbs then tends to bend them outwards, and produces bow-leg, while, if the feet are crossed one over the other, the curve will be most marked at the lower third of the tibia, and the leg which rests upon the other will have more of an anterior, and less of an external, curve than its fellow (fig. 76).

Defectivities of the **tibia** are more complex and difficult to explain than those of the femur; besides the general outward curve already described as a part of bow-leg, there are found curvatures of the tibia alone, the femur remaining quite or nearly straight. The most common curve in the tibia is a sharp bend with its convexity outwards and forwards at the lower third.



Fig. 76.—Children bow-legs; 'cross-legged' produces Curvature of the Tibia. The right foot is resting on the ground.



Fig. 77.—A pronounced case of Bow-leg.

Sometimes there is a projection outwards and backwards of the upper part of the shaft, just below the tuberosities, giving almost the appearance of a subluxation backwards at the knee joint. There is sometimes a condition of hyperextension in these patients, but the appearance is, we think, often due to the distortion mentioned (fig. 78).

In some cases there is a bend forward and inwards at the middle of the shaft, or rather, as this is associated with *gonæ valgæ*, it is to be described as a bending outwards and backwards of the lower half of the leg upon the upper.

It is common in severe cases of *gonæ valgæ* to find a well-marked rotation of the tibia upon its vertical axis, just as already described in the femur, so that, instead of looking inwards and forwards, the inner or subcutaneous surface of the tibia looks almost directly forwards (or sometimes the rotation is inwards—Revers); the upper third of the tibia may look almost directly forwards, the lower third inwards and backwards. In such cases the inner border of

the tibia is very strongly marked, forming a prominent ridge somewhat spirally twisted, ending below at the convexity of the forward curve, and above at the inner side of the internal tuberosity (fig. 78). In many cases, especially in those of long standing, whether this inner border is well marked or not, there is a prominent spur-like beak of bone developed below the inner tuberosity at the insertion of the internal lateral ligament; this spur, the existence of which was, we believe, first pointed out by Mr. Clement Lucas, is probably the result of ossification of the ligament as a result of strain and irritation, somewhat as in the case of 'rider's bone' and other instances of bony overgrowth at the attachment of greatly used muscles. The prominent ridges, as stated by Mr. Noble Smith, are most marked when the disease is arrested and the stage of hyperostosis has come on. Sometimes there is a flat surface of bone running up from the spur to the inner condyle of the femur (MacKenzie); in severe cases this is very striking, and the spur reaches down far below the direct insertion of the ligament. Two other conditions associated with these deformities require notice: one is that the patella in severe cases of knock-knee tends to ride outwards upon the external condyle, and even to be dislocated onto its outer surface during flexion of the limb. This is the result partly of deficient size of the external condyle and partly of the bony curves, so that the quadriceps, acting in a straight line, does not make traction in the axis of the bones. The patella may also sink so deeply into the intercondylar notch in flexion that its position may be marked by a depression. The other condition referred to is the direction and arch of the foot. In knock-knee the foot would naturally point outwards in consequence of the alteration in the axis of the limb, while in bow-leg the toes point usually, though not always, forwards or slightly inwards. Besides this, there is in some instances flat-foot more or less severe.

It has been asserted that flat-foot is really the cause of *genu valgum*, but that this is not so is by any means most cases is readily shown. Very often, instead of flat-foot, there is a condition of *pes curvus*, together with a peculiar spasmodic contraction of the great toe. Both the curves and the spasm of the flexor of the great toe are evidently due to the efforts made to obtain a firm grip of the ground in order that the instability caused by the knock-knee may be counteracted. Sometimes the great-toe spasm exists when flat-foot is present, and it is seen in bow-leg and curve of



Fig. 78.—A child of severe Rickets, showing most of the common deformities, as well as dwarfing from syphilis.

the tibia alone as well as in knock-knee. The foot is inclined to *plant* strain upon the internal lateral ligament of the ankle, the flexor of the toes, and finally posterior, as well as to allow the foot to be placed flat upon the ground; this tends to bring the bearing point upon the outer side of the foot and to remove the ball of the great toe from the ground; then, to compensate for this, the toe is flexed so that the last phalanx may take a share in the support of the body. These points are to some extent shown in the preceding figures.¹

To summarize, then, the following deformities may exist in the lower limbs as a result of rickets:

1. Curvature of the shaft of the femur, with its convexity *forwards*, or *forwards and outwards* throughout its whole length, together with rotation of the lower half upon the upper through a vertical axis.

2. Diaphysal overgrowth on one side of the growing line, absolute, or relative from atrophy of the other half.

3. Overgrowth of either condyle, with absolute or relative smallness of the other condyle.

4. Curvature of the lower third of the femur, with its convexity *inwards* (according to MacEwen the commonest cause of *genu valgum*).

5. Curvature of the shaft of the tibia as a whole, the convexity being directed *outwards*.

6. Curvature of the upper part of the tibia, so that the convexity is directed *backwards and outwards*: possibly this distortion is sometimes at the epiphyseal line.

7. Curvature of the shaft of the tibia at the middle, the convexity being directed *forwards*, or *forwards and inwards*.

8. Curvature of the shaft of the tibia at its lower third, the convexity looking *forwards and outwards*, more rarely *directly forwards*.

9. Rotation of the tibia spirally upon a vertical axis.

10. Overgrowth of the ridges on the tibia, especially the internal border and the region below the intertuberosity; similar outgrowths sometimes occur about the internal condyle and along the concavities of the curves of the femur, as well as in the neighbourhood of any of the epiphyseal lines.

11. Dislocation of the patella *outwards*.

12. Flat-foot, *pes planus*, spasmodic contraction of the flexor digitorum pedis.

13. The muscles and ligaments on the concavity of the curves in either direction may be contracted and shortened, those on the convexity stretched and weakened.

14. The pelvis and lower limbs may be stunted as a whole from lack of development or premature synostosis.

Late Rickets.—Though perhaps hardly coming into the category of children's diseases, mention must be made of the so-called 'late rickets,' or 'rickets of adolescence,' in which deformities, knock-knee, flat-foot, and more rarely bow-leg, come on between the ages of twelve and twenty years or thereabouts, the deformity being a bony and not merely a muscular or ligamentous one in the case of knock-knee.

This condition has been antedated as a disease allied to *osteomalacia*:

¹ MacEwen believes that flat-foot occurs in children before walking, but that on walking the convex and long spurs are developed.

it has also been described as relapsed rickets, and by Mr. Lucas has been said to be associated with masturbation and alluvinitis. As to these alleged causes we may say that it is not often, we think, relapsed rickets, for we have seen many instances where there was no evidence that rickets had ever existed in childhood. It is not osteomalacia, for the patients never die of the disease, the process becomes arrested, and it does not occur under the conditions met with in attack of the parts affected in osteomalacia. It is certainly not due to, nor even associated with, either alluvinitis, or masturbation in any cases all instances. We have examined such patients a good many times, and in only one was there even a trace of alluvitis in the urine, and, as is well known, this may occur quite apart from the condition under discussion; in none of our cases was there any evidence of masturbation. It is, we believe, due simply to weak health, bad air, long standing, poor food—in short, to bad hygienic conditions at a time when growth is active in the limbs—in fact, mainly to those causes which produce rickets in earlier life, but in consequence of the greater strength of the skeleton and its more complete ossification, as a rule it only produces deformity in those parts on which the greatest strain is thrown; in some cases there is well marked enlargement of the epiphyses, of recent appearance, and not dating back to the initial time of rickets: this we have seen, and other cases have been recorded where both the external and microscopical appearances were identical with rickets.¹ The affection is, we think, best described as late rickets; it furnishes a large number of the patients upon whom osteotomy is such life is performed.²

Secondary.—A child, then, suffering from knock-knee the result of rickets, will present the following appearances in addition to evidences of rickets in other parts. As he stands the femora will be seen to project markedly forwards and outwards, the extensors of the thigh being firm and prominent. There is often some flexion of the thigh upon the pelvis, and of the legs upon the thighs; and secondary lordosis, resulting in a peculiar doubled-up and crouching attitude. The legs are set at an obtuse angle with the thighs, the patellæ are displaced outwards, and the internal condyles of the femora look forwards and inwards, instead of directly inwards; the whole limb is in fact rotated outwards. The tibial ridges are rudely developed, and there is a spiral twist in the leg. The feet are directed outwards, though the toes are somewhat adducted, and quaternally grasp the floor, the flexors being strongly contracted, especially that of the great toe; the arch of the foot is exaggerated, or may, on the other hand, be lost. In walking, one knee passes in front of the other, in severe cases to such an extent that the appearance is that of a person walking cross-legged. The patient's height is much less than it should be from the actual length of the limbs, and he is easily tired and complains of aching of the legs, especially on the inner side of the knee if the deformity is increasing. In other instances, however, though much deformed, the child is as active and sturdy as his fellows, and makes no complaint of pain or tiredness; when this is so, the distortion is usually

¹ F. H. Clifton, *St. Thomas's Hospital Reports*, 1884, and Mikulicz referred to in Macewen's book.

² Mr. Reeves in *Practical Orthopedics* gives an elaborate account of the causation of bone deformities, which we are not altogether able to follow.

not increasing. On examining the knee more closely it is found that on flexion of the joint the leg can be brought into the same line with the thigh—a result due to the slipping back of the tibia from the more prominent part of the condyles to the posterior surface.¹ The internal condyle can be felt to be larger and is descended lower than the external, so that if the limb is placed in such position that the lower borders of the two condyles are on the same level, the axis of the femur is much more oblique than in a healthy limb (Brevers). The patella in extension keeps its natural position; while in flexion, as already noticed, it slips outwards and leaves the intercondylar notch plainly perceptible,² the appearance being much that of fig. 176. On attempting to straighten the limb during extension this will be found impossible, though a little lateral movement may take place, and the tendons of the biceps and the distal tibial band of fascia will become very tense. The head of the fibula is swollen, and concealed deep within the angle between the tibia and femur. The seat of pain and the tubercle at the insertion of the internal lateral ligament have been already alluded to.

The degree of deformity proven varies greatly, but never reaches nearly the extent in children that it does in adults; in an adult case we have seen the leg almost at a right angle with the thigh, and in another that we operated upon there was 19½ inches between the malleoli when the inner condyles were in contact. In double *genu valgum* ten inches deviation would be an extreme case in a child, and five inches a severe one.

In measuring the deformity it is best to lay the child upon a flat, hard surface; the legs must then be fully extended and rotated inwards until the front of the lower end of the femur looks directly forwards; the two internal condyles are then to be put just touching one another. A vertical line is then drawn through the umbilicus and centre of the pelvis downwards to the level of the malleoli, and on measuring the distance from the inner malleolus on each side to the vertical line the amount of deviation will be ascertained. In double *genu valgum* the line will, if the limbs are symmetrical, pass through the point of contact of the condyles, while in bow-leg it will lie far within the arc of the upper part of the limb, but may pass to the outer side of, or through the ankle.

Knock-knee in children does not always depend upon rickets, and it is important to recognise this fact. It may simply be the result of lax ligaments without any primary or even secondary alteration in shape of the bones; thus a child may have marked *genu valgum* while standing up, but on lying down it may be possible to bring the legs perfectly straight, and to again produce the deformity by steadying the thigh and abducting the leg; a distinct gap will then be felt between the femur and tibia on the inner side, and lateral rocking may be easily shown. In such patients the deformity may after a time become permanent from stretching of the muscles and ligaments on the inner side and contracture of those on the outer aspect.

A similar deformity in one of our patients was the result simply, apparently, of hysterical contraction of the muscles on the outer side, with weakness of the internal set, "*muscular spasm*" (Göhrn).

¹ Other explanations have been given, such as that it is due to eversion of the knee at the hip (Noble Smith); but this is not very intelligible. Brevers gives Haskin's view that it is due to obliquity of the axis of rotation.

² This occurs only in severe cases.

Treatment of Rickety Deformities.—The degree of deformity, the age of the patient, and the state of the disease, whether stationary or getting worse, and the amount of care and trouble that can be bestowed upon the child, are the points to be considered in the treatment of these cases. Then it is useless to attempt to treat by instruments or splints a very severe case of distortion, while, on the other hand, it is rarely necessary to perform osteotomy upon a child under three years old because the application of splints with or without previous forcible straightening, if it is a case of curve of the tibia alone, will usually suffice for a cure. Again, if the deformity has been stationary for some time and it is probable, therefore, that the post-rickety sclerosis of bone has taken place, it is useless to think of straightening the leg without operation, while if the curvature is getting worse, it is probable that the bones are still sufficiently soft to yield to pressure. Besides these considerations comes the very important one of the amount of care and time that can be bestowed upon the child; it is not only justifiable, but necessary, to perform osteotomy upon many children who could be straightened perfectly well without operation if they could be seen frequently by the surgeon, be kept off their legs, and their splints properly applied; but who are neglected, allowed to get about anyhow, and their splints are applied wrongly or not at all. In such cases it is mere waste of time to do anything short of operation; hence we have frequently osteotomized or forcibly straightened the limbs of children between two and four years old, and we entirely disagree with the view that it is barbarous to operate upon young children who could be straightened without operation if it were possible to give all alike the same care and time. At any rate, it is practically a choice between their remaining crooked and osteotomy or fracture. The general constitutional treatment of rickets has been already considered elsewhere. The local treatment consists in operative and non-operative means.

Treatment without Operation.—In a young child with the deformity increasing, but not very severe, who can be well looked after, the treatment of knock-knee consists in forbidding him to stand at all, in bathing and rubbing the limbs well to improve their circulation and muscular power, and in using firm, steady traction in the direction of straightening the limb, as if to break the leg across the knee, for ten minutes at a time night and morning, such force as can be borne without pain being employed, and care being taken that the limb is fully extended. For the rest of the day and at night the child should wear a light, slightly hollowed, straight splint, long enough to reach from the top of the trochanter to just below the sole of the foot. This splint should be fixed to the upper part of the thigh and the lower part of the leg by elastic webbing straps, while over the prominence of the knee an elastic strap should be applied to draw the knee outwards against the splint; we prefer this plan to bandaging only. As soon as the child's health is improved, or if the case is very slight, a shorter splint may be employed and he may be allowed to walk about wearing it.¹ If it can be afforded, a light iron splint may be used instead of the wooden one; the one figured on p. 418 is a very good form.

¹ We may here again remind, once for all, that a child may get fresh air and exercise without walking, and that in the poorer classes, where we chiefly find these deformities, it is useless to attempt treatment in at all severe cases if the child walks about.

If the distortion is at all severe, a practical difficulty will be met with in applying and keeping on the wooden splint: it will be found that the splint slips round to the antero-external aspect of the limb instead of remaining at the outer side; when this happens no traction is exerted upon the knee, and the splint is useless. In such cases, if the iron cannot be obtained, a back splint rather broader than the limb and as long as the outside one should be first applied, and then the outside splint put on with its edge resting against the edge of the back splint; this will be found to prevent rotation. The two splints can be joined together so as to make a single hick-box splint—a plan first used, we believe, at the Victoria Hospital, Chelsea. Thomas's knee splint may also be used for these cases: its advantages are that the child can get about from the first, and that elastic traction can be employed with it; its disadvantages that it is somewhat troublesome to get made correctly, except at the price of a guinea, and that it is somewhat difficult to prevent rotation in it. Many other forms of appliance may be brought, but those mentioned are in our opinion the best. Whichever splint is employed, complete extension of the limb is necessary for the apparatus to produce any effect.* For bow-leg it is only necessary to apply the splint on the inner side instead of the outer, and it is much easier to manage, since there is little tendency to rotation of the splint. Latent curve of the tibia is treated in the same way, but the splint need not reach



Fig. 75.—Thomas's splint for Genu Valgum. The part is applied to the great trochanter and the splint becomes a support at the foot. An elastic strap draws the knee forward.

above the knee: the anterior curve requires a back splint with a foot piece, and is more troublesome to manage, pressure being difficult to apply without causing pain at the heel. A simple anterior curve is, however, a much less serious deformity than the other, and is much more prone to improve without apparatus.

Operative Treatment of Rickety Deformities.—Operation is required in patients in whom the deformity is severe, in those who have recovered from the rickety process and whose bones are sclerosed, and in those who cannot be well looked after or submit to prolonged treatment.

Operative measures are of three kinds: fracture after partial division of the bone with saw or osteotome, forcible straightening without external wound, and straightening after amputation, &c. In cases of curvature in the shaft of the tibia and fibula at the lower part of the leg in young children, before sclerosis has occurred, we consider forcible straightening a good and simple plan, resulting in a green-stick fracture just at the curve. It is, in any case, variable for it, easily done by taking the child's limb in one hand *just above*, and in the other just below, the deformity, taking care to have hold of the

* Hunter bones green & injured by simple flexion, and Little thinks well of it, but suggests adding a *de Torsion* as needed.

tibia and fibula, and rest of the foot, otherwise the strain would come upon the ankle joint; the limb is steadily and forcibly bent straight by the hands; a certain amount of jerking is, however, sometimes useful. Tenotomy and subsequent straightening in cases of *genu valgum* we look upon as highly objectionable: it weakens the joint and only temporarily straightens the limb.¹ As to forcible straightening in cases of *genu valgum*, we have strongly condemned it in former editions, but having asked Mr. Murray of Liverpool to give his experience, he writes thus:

During the last three years I have practised somewhat extensively a method of treatment that was recommended by Professor Ogston at the Glasgow Meeting of the British Medical Association—viz. immediately and forcibly correcting the deformity, and then applying the splint. I have thus straightened more than four hundred knock-knees, and have every reason to be well satisfied with this line of treatment. But in speaking of remedies for *genu valgum*, I wish it to be clearly understood that I propose it chiefly as a substitute for splints, and consequently only only to the treatment of this deformity as it occurs in quite young children, that is to say, in children under five years of age, or in those a year or two older who are moderate cases.

Many surgeons, I believe, practice osteotomies for curved tibiae, but comparatively few do so for knock-knees. The objection, it is said, being that in so doing you produce a separation of the lower epiphysis of the femur, and so may interfere with the subsequent growth of the limb. Now I have on several occasions forcibly straightened a knock-knee on one side only, and have examined the children eighteen months afterwards, and found absolutely no difference in the length of the limbs. And further, at the time of operation, I examine for the seat of fracture, and find that it almost invariably takes place at a point where the lower end of the femur joins the shaft, and quite as high above the epiphyseal line.

My hands are the only osteoclasis I have ever used, and in forcibly straightening a knock-knee (say that of the right side), standing to the right of the patient, the child of course being under chloroform, I grasp the thigh firmly with my left hand about two inches above the patella, using my index finger supported by my other fingers as a fulcrum, and hold the thigh perfectly steady with this hand; then, with the right hand grasping the leg just above the ankle, gradually straighten the limb, the knee-joint being kept over-extended the whole time.

After osteoclasis I put the limb in plaster of Paris which is kept on for a month; the plaster is then removed and the child keeps off its feet for a further period of six weeks, after which it is allowed to walk about, constitutional treatment being, of course, adopted from the first.

There is no doubt that in children over five years of age considerable force is sometimes necessary; if, however, in attempting to forcibly straighten a crooked bone one has to use so much force as to render it uncertain where the fracture will take place, then you had better desist and perform an osteotomy.

Mr. Murray, in addition to writing the above account, has been good enough to come over and show me his *modus operandi*, and we must admit that, strictly within the limitations of age and rigidity of bone that he mentions, and provided his exact method is followed, we are convinced that the operation is safe and practicable; but Mr. Murray's method must be absolutely followed, and the exact site of the fracture determined; it is not, however, every surgeon who has Mr. Murray's skill. Other methods of treatment do not require further notice.

Osteotomy.—The general principle of an osteotomy is to partially divide with a saw or chisel the shaft of the bone in the neighbourhood of the

¹ Vide Lauenroger, *Le Bull. Méd. des Facultés de Médecine*, January 1888.

deformity through a small wound, then to complete the fracture, straighten the limb, and treat it like an ordinary compound fracture.

Of the various operations devised by Ogston, Macswen, Elms, Rivers, Schuch, and others, for remedying gross valgus, is the experiment that of Macswen and his version of the femur above the condyles by means of a saw from the outside into the bone. This plan was, we believe, first employed by our colleague Prof. T. Jones. We occasionally do an Ogston's operation, but supersede it with a fine Adams or keyhole saw is, we think, the most generally useful method. Ogston's plan should be limited to those cases where the deformity is entirely due to crumpled overgrowth. It is very seldom employed. In the case of immobility of the limb we prefer to saw through the vein and fracture the bone freely, so, if that cannot be readily done, we divide the skin with an oblique incision through an incision on the inner side of the leg.

After straightening the limb we put it up in a back and side splint, one or more, according to the deformity, or in a Macswen's splint, and leave it for a week; at the end of that time we take it down and mould it accurately into position under chloroform; the splint is soft and moulds easily; the limb is then ready for a plaster of Paris splint, which should be kept on for three or four weeks and then taken off, and the limb well rubbed, the joint flexed, and then the splint replaced for another week; after that the child may be allowed gradually to put its weight upon it. Its heavy clothes at this week should be given, and a light wooden splint worn for another month or so. It is a good plan to put on a Thomson's knee splint after the first month or more sooner.

In severe cases of lateral curve, especially of oblique curvature and in some of those of the upper part of the leg, the deformity cannot be remedied by a single section, but requires the removal of a wedge of bone; this is a very much more serious operation, and one that we think should not be performed for the common curvature, for besides its severity, it does little towards the correction unless a great amount of bone is taken away, and the results being divided as well. This extreme curve is also much less important than the lateral one. If osteotomy is required to such a point, the *Multiplexion of Canalis* is probably the best.

Osteotomy is a simple operation, in most cases, but it has its dangers and its morbidities. The exposed artery has three times been wounded, never bleeding but also covered from the anatomical magna, death has followed in some few cases, and gangrene of the leg in one or two at least on one of our cases, in which we removed a wedge from the upper part of the shaft. In this, our only serious mistake, no vessel was wounded, but other has gained of the bone in their almost position, or from the splint being put on too tight, the limb had to be amputated subsequently. There is no comparison between limb extension and excision of a wedge of osseous. For details of the various operations we must refer to the orthopedic and general surgical works.

Drilling holes in the bone and subsequent fracture, with modifications of this plan, have, we think, no advantage over the two more obnoxious, which of these is used is nearly a matter of indifference.

Multiple osteotomy, i.e. section of bone and then at one or more points, we sometimes required, when this is so we prefer to do one at a time on each limb, though Macswen has many times done several with perfect success. Deformation of the limb after these risks are never important.

Osteotomy of the femur with a saw from the inner side is best performed by placing the limb upon a sand pillow, with the knee slightly flexed, and making a puncture with large lancet on the inner side of the limb, just in front of the border of the tendo vagus, femoris, and a finger's breadth above the level of the adductor tubercle. The knife is then carried across the bone, keeping as close to the bone as possible, taking care not to thrust it through the skin on the inner side. In this part of the incision the limb should be held flat, so, in the same place on the surface of the femur; as soon as the inner side of the limb is reached the knife is turned with its edge against the bone and withdrawn. It should starting withdrawn be gently pressed against the bone so as to divide the periosteum and form a track for the saw. As soon as the knife is taken out of the wound the mirror saw is thrust sharply with a jerk into the skin wound and its point

made to strike the femur; it is then carried readily over the front of the bone and is put just beneath the skin on the inner side. The limb is well stretched and the femur is now being taken to see at right angles to the axis of the femur. In sawing, the hand should be lifted, so as to divide exactly the inner and front parts of the shaft, and nearly the whole thickness is sawn through. It is a matter of experience how far to saw usually about two-thirds of the way through is sufficient; a useful guide is the depth of the saw from the front of the bone as felt through the soft parts. When the bone is fairly divided the saw is withdrawn, the limb secured by the hand nearest the patient's neck, and the limb bent inward by advancing the leg with the other hand. The bone-sawman snaps sharply and sometimes pulls. In the latter case violence has not probably gone so far, and the fracture is more or less green-stick. One of our house surgeons remarked that the patient had less pain after these pulling fractures than when the division was complete, no doubt because there was no complete separation and immobility of the fragments.

Should the saw have been withdrawn too soon, and it is found impossible with reasonable force to fracture the limb, it is usually easy to redivide the saw and divide the bone further: the groove already made is usually found without much trouble; being so, the best plan would be to collapse the spring and divide the bone with an osteotome.

Some of the ribs is done in the same way, the patient being made over the anterior border of the bone at the line of greatest curvature. It is usually possible to fracture the rib; if not, it should be divided with an osteotome through an incision over it. Macleod's operation we need not describe, as far general use we judge the method already mentioned, but we may say it consists in incomplete section of the bone with a graduated instrument from the inner side, through articular in the soft parts. His guides are 'a line drawn a finger's breadth above the level of the upper border of the external condyle, and a line drawn parallel to and half an inch in front of the shadow of the adductor magnus.' The point of intersection of these lines is to be the centre of the incision. In case of these operations no deep ligature is either required, and deep sutures should be easily carried out. The wound in the soft parts is usually usually is a nick, or a piece of superficial granulation above remains, and it is only occasionally that the dressings require changing from sores of blood. It is well to remove all the blood out of the spring before putting on the dressings.

The deformity resulting from non-union of the fragments after these operations gradually resolved down after a few months just as in a fracture. Oblique section of the bone is a guide in plan suggested by Mr. Gibson, is sometimes worth trial; it causes less immediate deformity, but is somewhat more difficult to manage.

Lateral Curvature of the Spine.—This affection in its most common form is a disease rather of early adult life than of childhood, being seldom found before puberty, hence only the more important features will be considered here. There are, however, certain forms of scoliosis that belong to childhood more particularly; such are the tickety lateral curvatures and those due to rickets or unilateral limb-shortening, as well as, of course, the congenital cases. It must be remembered that in infants the normal curvatures of the adult spine do not exist.

It is now well recognised that the deformity is a compound one, that there is never a pure lateral curve without rotation, nor pure rotation without a lateral curvature, although it may in some cases require close observation to verify this, and the more so that rotation conceals to a greater or less extent the deviation of the spinous processes by bringing them nearer the middle-line.

As soon as any lateral bending in one segment of the spine occurs, two things necessarily happen if the child maintains the erect posture: first,

compensatory curves must take place in the other parts of the spine to balance the primary curve and maintain equilibrium; next, the obliquity of the articular processes, and in the dorsal region the powerful rotation action of the ribs when they are approximated, must result in rotation of the vertebrae upon a vertical axis.¹ Hence in a case of a lateral curvature we almost always see compensatory curves in the opposite direction, and invariably more or less rotation; the term *rotato-lateral curvature* is therefore the more exact title. *Scoliosis* is convenient as a short synonym. *Scoliosis* in children may be the result of—

1. Congenital malformation of the spine, in which imperfect segments of vertebral bodies are intercalated on one side of the spine only. (Blind Sutton, "Med-Chir. Trans." 1884.)

2. Congenital deficiencies in the limbs of one side, so that the action of the muscles and the weight of the normal limb are unbalanced.

Occasionally scoliosis is secondary to the form of congenital torticollis which is due to malposition in utero.

3. Shortening of one leg from any cause: for instance, a flexed, unclipped leg or knee gives rise to stooping and compensatory scoliosis.

4. Imperfect development or sinking in of the chest-wall on one side, as in *sick-chest* or *emphysema*.

5. Muscular and ligamentous weakness combined with faulty attitudes.

6. Rickets.

7. Cancer, especially if one side of the bodies only is involved.

Various other types of scoliosis have been described, but they may all be practically grouped under one or other of the above heads.

The mode of production of *rotato-lateral curvature* by the above causes is obvious except in cases of Group 5, of which a word or two more must be said. It is usually stated that this form of scoliosis is a disease of the upper classes, and is found in girls who kill about or sit in ungainly attitudes for long hours, writing or working, during their most active period of development, while at the same time no sufficient exercise is given to their muscles. While it is true that weak spines or slight degrees of curvature are often thus produced, the disease is common enough among the poor, and, as it is usually neglected in its earlier stages, is seen in much worse degrees. It is also not rarely found in muscular, well-developed people in early adult life. It is, moreover, at times produced in young girls by carrying heavy babies or other burdens too great for them.

The whole spine should in all cases be carefully examined with the patient stripped, and the back should be inspected in different positions of curvature and of the limbs, the course of the spine and the level of the scapula and iliac crests being noted.

If a weak or fixed spine is examined with the patient stripped and standing or sitting upright, it will perhaps be seen at first to be held fairly straight, but often after a minute or two the weight is thrown to one side, the lumbar vertebrae curve with their convexity towards that side, and a compensatory dorsal curve appears with its convexity to the opposite, usually the right, side, while a slight alternating curve in the cervical region

¹ Johnson of New York attributes the rotation to the fact that the ribs are attached to the spine behind the bodies—the latter, as it were, are free in the thoracic cavity, and therefore liable to rotate, while the spines form part of the thoracic wall.

is sometimes readily seen. At the same time flickering contractions of the spinal muscles as they become tired are often visible. In an early case all these bends can be straightened out by an effort of the patient, or by bending forwards or by lying down. If, however, the patient is neglected the curves tend to become permanent, for the weak muscles become contracted on the concave side, the ligaments become shortened, the intervertebral discs thinned and compressed, and the shape of the vertebral bodies and articular surfaces at last altered. But while this is going on the vertebrae rotate upon a vertical axis so that the bodies come to face towards the convexity of the curve, and the ribs become bent in such a way that there is a sharply convex bend backwards close to their angles on the same side: this produces a prominence also on the convex side, while in front, in order as it were to reach the sternum, the ribs are usually more or less flattened and straightened out. The converse of all this takes place on the opposite side of the spine. There is still a further change resulting from this: the scapula on the convex side is pushed out by the bulging ribs and projects backwards, while it is raised or lowered above the level of its fellow according to the exact seat of the curve; this is so marked that 'growing out of the shoulder' is usually the first noticed sign and the popular name for the affection. The scapula on the concave side also often projects sharply backwards and towards the mid-line, since it cannot rest evenly against the flattened chest wall (note fig. 80). A projection of the hip on one side or the other according to the curve will also be noticeable.

All degrees of deformity may be met with, from the mere weak spine, with no permanent curves, but with a tendency to collapse in any direction, to deformity, where the ribs on one side are overlapping one another and lying within the crest of the ilium, while the whole trunk is distorted and misshapen. Sometimes an antero-posterior curve (kyphosis) coexists with the scoliosis, and it is very important not to be misled by this; still more important is it to remember that in cases of caries there is sometimes a lateral curvature before any angular curve appears: this may occur either in cases of the bodies or, as pointed out by Reeser, where there is disease of the articular processes or costo-vertebral joints. The diagnosis is to be made by testing the rigidity of the spine and usually the greater severity of the pain in the case of caries, as well as by the history of the patient. The exact position of such curve is by no means constant, and, though a curve convex to the left is the lanthan and convex to the right in the dorsal region



Fig. 80.—Lateral Curvature of the Spine.

in the commonest condition, the lower curve may be dorsolumbar as the sides may be reversed, and so on. This, of course, depends largely upon the cause of the curvature; thus in emphysema the amount and position of the collapse will determine the curve. Sometimes, especially in rickety cases, and probably in those due to partial atelectasis, the curvature is local and the compensatory curves are so slight and diffuse as to be nearly imperceptible. In some cases curvature of the spine is to be looked upon as compensatory and advantageous, and not as a morbid condition; such are slight curvatures which make up for inequality in the length of the limbs and the slighter degrees of curve due to emphysema; thus in one case the curve may help to hide the deformity and in the other assist in filling up a supporting cavity.

Aching pain of greater or less severity, and a general feeling of tiredness with depression of spirits and bonelessness, are the principal subjective symptoms of lateral curvature. The pain is usually in the side and not in the back or chest and abdomen.

Treatment.—Scoliosis due to congenital malformation of the spine itself or to deficiency of an entire limb, as well as that due to collapse of the chest-wall after emphysema or severe atelectasis, is necessarily not entirely and in many cases not at all reparable, while curvature due to rickets, weakness, bad habits, or a shortened leg may in its early stages be entirely cured and in almost any stage prevented from getting worse.

In any case the aim must be to first remove the cause tending to increase the deformity, to improve the general health, to strengthen the muscles and ligaments, and to avoid pressure and strain upon the weak parts. In the rickety scolioses of young children the rickets must be treated and the child never allowed to remain sitting up for any length of time; its general posture must be flat upon its back or face, or upon its side, with pillows so arranged as to straighten out the curves. The principle is not to keep the patient lying down, which would of course in no way strengthen the muscles, but to give the parts just such exercise as will make them develop, and in the intervals give them complete rest.

Fresh air, friction to the spine, with frequent change of posture and proper diet and medicine, will readily cure any case in which there are no fixed curves, while in the more severe cases in older children the same treatment must be adopted. In an ordinary case, the result of weak muscles and joints, and improper posture, the lines of management are to avoid tiring the muscles and ligaments, and yet to strengthen them by exercise; to avoid the postures which have produced the deformity; to counteract their effect by opposite postures, thus stretching contracted muscles and ligaments, &c. It is impossible here to enter into details of the various exercises required or of the different apparatus recommended, but it may be said that in addition to all means of strengthening the health and improving the tone of the muscles—friction, salt-water douches, general exercise, and so on—a careful examination should be made with the child stripped entirely to see what postures and movements tend to correct the deformity, and these should be made the subject of regular practice at intervals through the day. A reclining board such as that figured (fig. 51), or some similar one, horizontal bars, trapezes, dumb-bells, Sayre's suspension apparatus, and so on, are all useful as means of strengthening the muscles.

Regular walking exercise for frequent short periods should be taken, the patient lying down afterwards, and constant watchfulness to correct any tendency to loll must be observed. Busch's plan of making the patient lie prone, with the chest and head over the end of a couch, then bending downwards and raising the front half of the body against gradually increasing resistance, is a good method of exercising the spinal muscles. Bending the body forward with the knees straight and trying to touch the toes with the hands, then recovering and bending backwards with the head well thrown back; keeping head and shoulders back and leaning towards side of greatest convexity, then recovering upright posture: lying down with large hand



Fig. 1.—Buckling Board for Lateral Curvature, with Extension Apparatus for the Head and Arms. The head stage has been omitted for clearance, and only part of the couch is shown. Both head and hand stages are fixed with self-adjusting accumulators.

pillow or Barwell's sling under the convexity of the ribs; raising the arms on concave side and pulling the body up by it by means of horizontal bar or rope; all these are good movements. For private patients much time is saved in the surgeon and expense to the patient by instructing a professional masseur or gymnast to carry out such manipulations as the surgeon may order.

It is a good plan to let the patient sleep in a Barwell's sling or put a hard pillow under the convexity of the chest and remove the one under the head, or substitute a thin one for it. Of facials 'reductionment' we have no experience, but careful wrestling of the deformity with the hands is worth doing.

All spinal supports are to be reserved for cases where the deformity is extreme or rapidly increasing, and must be used with the greatest caution and never relied upon except in conjunction with the exercises and other means already indicated. As a means of treatment alone they are as harmful as in cases they are useful. No cases of lateral curvature must ever be given up to the care of an apparatus maker. For details as to spinal supports, modes of measuring the deformity &c. the works of Brown and others may be consulted, but, as a rule, the less supports are used the better.

Antero-posterior Curvature.—Occasionally cases of antero-posterior curvature (kyphosis) are met with in children, both in infants and in those of older growth. These must be distinguished from the common rickety kyphosis. They give rise to an appearance closely resembling the stooping and hunchback of old age, and may be mistaken for cases of caries. Absence of rigidity and pain, and of evidence of tubercles will usually enable these cases to be recognised, but it is well to watch them closely for a considerable time before assuming that there is certainly no caries. Exercises and a suitable light steel support are the best means of treatment.

NOTE.—The subject of 'Flat-foot' is, for convenience sake, considered in the chapter on 'Club-foot.'

CHAPTER XIX

SYPHILIS

INFANTS and children may suffer from syphilis acquired in various ways after birth, or they may be the subjects of hereditary syphilis, the virus in this case being received from one or both parents during intra-uterine life, or the infant may be inoculated with the syphilitic poison at the time of birth.

Acquired Syphilis.—Can a healthy infant be syphilized by means of the milk of a wet-nurse? This is an important question, and one which is often asked by parents before a wet-nurse is employed; there is no evidence that we know of to show that it can, and there is a strong probability that even if the virus was present in the milk it would not inoculate the infant unless introduced directly into the blood. That the infant can be inoculated if it have an abrasion on the lips and it draws blood from a sore nipple of a nurse suffering from secondary syphilis is certain, and it may, of course, be inoculated by the discharges from the genitals of the nurse conveyed to it on the nurse's hands. It need hardly be said that in selecting a wet-nurse the most scrupulous care should be exercised in ascertaining that the would-be nurse is not suffering from any specific disease, a careful inquiry being made as to her health and the health of any children she may have had, especially with regard to any symptoms of syphilis.

Children of various ages may be seen in dispensary practice suffering from chancres on the lips and genitals, who have been inoculated from their parents or others having specific sores, the virus being perhaps conveyed on the fingers. It is important to bear in mind that not only are the discharges from a primary sore liable to inoculate, but the discharges from various secondary lesions both in acquired and hereditary syphilis may also infect. Thus infants suffering from coryza or specific ulcerations about the mouth may inoculate the breast of a healthy wet-nurse, though they apparently never do that of their mother. No syphilitic infant should be wet-nursed by any one except its mother.

Syphilis has undoubtedly been on rare occasions inoculated by means of **vaccination**; abundant evidence of this exists in some epidemics of syphilis which have occurred, though such an accident is exceedingly rare, especially when we remember the frequency with which vaccination is done and the certainty with which such an accident is discovered. It may often happen that when vaccination is performed it is followed in a few days or weeks by symptoms of secondary syphilis, such as a roseolous rash, coryza, &c., but in the absence of a primary sore at the seat of vaccination these syphilitic manifestations cannot be accepted as evidence of vaccino-syphilis, and

evidence may most probably be obtained of syphilis in the parents or in some of the brothers or sisters. As the first symptoms of hereditary syphilis most frequently make their appearance at from six weeks to three months after birth, and as this is the usual time for vaccination, it is highly probable that vaccination and the secondaries will when exist together and yet have no connection. If syphilis has been inoculated by vaccination, a month or six weeks later—during which time perhaps the vesicles have imperfectly healed—an induration makes its appearance at the seat of one or many of the vesicles, or there is an ulcer with an indurated base which has the character of a hard chancre; this remains indolent, crusts over, and is followed in the course of a few weeks more by a specific eruption and other specific phenomena. In any case where vaccin-syphilis has taken place a well-marked scar is left at the seat of the pustule where the hard chancre has formed.

It is important to remember when investigating any case of supposed vaccin-syphilis that an interval of a month or six weeks elapses between vaccination and the formation of a chancre at the seat of inoculation (Hutchinson), and the diagnosis of syphilis cannot be accepted unless this is the case.

Hereditary Syphilis.—In hereditary syphilis the fetus receives the poison at some period during intra-uterine life, and may be born with the evidence of syphilis on it, or it is born healthy, the specific symptoms making their appearance within a few weeks or months of birth. In these cases, unlike acquired syphilis, there is no primary sore. The part played by the father in transmitting syphilis to his progeny does not admit of a doubt; the more recently he has suffered, the more likely is he to transmit it in a severe form, though for many years he is liable to beget children who suffer from hereditary syphilis. The most usual way in which he transmits it is by means of the spermatozoa at the time of fertilisation of the ovum; or during the intra-uterine life of the fetus the mother may become infected by the husband, and she may infect the fetus through the placental circulation, though this appears to be rare during the later months of intra-uterine life. The mother may transmit the disease to the ovum or the fetus in utero, but this, as just stated, is rare after the seventh month of fetal life; or she may infect it during the act of birth. The mother, on the other hand, may apparently be infected from the fetus, though often she appears to escape; that is, a syphilitic father infects the fetus, the child is born and suffers from syphilis, the mother apparently escaping; but the escape of the mother is *not* apparent than real, inasmuch as such women appear to be invulnerable to syphilis, and there is reason to believe that they do not escape, though the attack must certainly be slight. (Collier's *law*.)

A. Baginsky gives the following summary of the etiology of congenital syphilis:

(1) If the father and mother are both syphilitic, a syphilitic infant is generated, or the mother may miscarry; the more severe and recent the syphilis is in the parents, the more likely is the fetus or infant to suffer severely.

(2) If the father is syphilitic and the mother healthy, the infant may be syphilitised at the time of conception, and this may happen when the father is affected by tertiary as well as secondary syphilis. Under these circumstances

the mother may be syphilitic either through the spermatozoa or from the fetus through the placental circulation; she may apparently escape, but such women cannot be inoculated.

(3) If the mother only is syphilitic the children may escape; certainly mothers with tertiary symptoms may bring forth sound children.

(4) If the father and mother are healthy at conception, and the mother becomes affected during pregnancy, the fetus becomes infected through the placental circulation; an infection during the act of birth is possible.

Effects of the Poison on the Fetus.—The mother may miscarry at any time during fetal life, a result due to disease of the fetus or placenta; this is especially likely to happen if the father and mother are suffering from the disease in an active form. The exact nature of the lesions is uncertain; the placenta and internal organs, as the liver, lungs, &c., have been found diseased. The infant may be born at term, but dead, or may survive its birth but a short time; in the latter case it is puny, shrivelled, with blue ecchymoses and a feeble hoarse cry. It may suffer from various skin eruptions, the most common (in the newly born) being pemphigus; various internal lesions may be found, such as interstitial hepatitis, and there may be gummata, perhaps breaking down, in the thymus, heart, or lungs. It may exhibit a tendency to bleed (see p. 26).

Symptoms and Course.—The first definite symptoms usually make their appearance during the second month of life. These are often preceded by more ill-defined symptoms, such as restlessness, fever, peevishness, diarrhoea, and dyspepsia. The infant suffers from what appears to the friends to be a cold in the head; the nasal passages are obstructed by excessive secretion and the infant 'snuffles' during inspiration; in the more severe cases the breast is taken with difficulty, as respiration is impeded during sucking on account of the nose being blocked, and the infant has to stop to breathe through its mouth. The coryza is followed by a characteristic rash, which usually consists of



Fig. 15.—Fumous round the Mouth is a sign of Congenital Syphilis. The whole appearance of the face is characteristic.

an erythema or erythematous patches of various sizes, the favourite places being about the anus, genitals, thighs, and forehead. Instead of an erythema the rash may be papular. When the eruption appears first it is a bright red, the vividness fades in a day or two, and the skin desquamates, and becomes of a dull red or coppery hue. As the disease progresses the secretion coming from the nose

dries up and forms scabs, the entrance to the nostrils becomes sore, and perhaps a suppurating parient secretions escapes from time to time. The upper lip may become excoriated and scabbed over. The corners of the mouth, which are constantly moist from the excess of saliva, become raw and perhaps ulcerated; fissures and scabs may form which heal but slowly, leaving radiating scars (figs. 82, 83).

The mucous membrane of the larynx may become affected, being swollen and perhaps ulcerated, and the child in consequence has a hoarse cry; there may be marked anæmia and wasting, so that the child shrivels up and becomes reduced almost to a skeleton.

Infants occasionally die at this period, apparently from the intensity of the poison. This seems to have been so in the following case—our first *autopsy* notes are as follows (the child was not seen during life by any medical man): 'The mother states the infant, which was seven weeks old, "swelled" a week before its death, and three days before a reddish rash appeared on the buttocks and around the mouth. It was found dead in its cot. At the autopsy the infant was fairly well nourished, there was a parient discharge issuing from its nose, the skin around the mouth and nose was excoriated, apparently from the nasal secretion, and there were some excoriations and redness around the anus. The whole of the mucous membrane of the nose was in a foul, almost sloughy condition, the surface being dark-coloured and covered with mucus-pus. On one nasal there was a deep ulcer; there was no laryngitis; all the other organs in the body were healthy.'

While in the more severe forms the infant is the colour of *egg as laid*, wasted and wasted, other infants may be seen who are plump and ruddy, yet who are undoubtedly syphilitic, and who subsequently develop a typical rash. In some who suffer later from syphilis no history can be obtained of coryza or rash, and we are driven to the conclusion that the secondaries are sometimes so slight as not to attract the attention of the friends, and may even deceive the medical practitioners. The mortality of syphilitic babies is high; not only is the effect of the poison depressing, but the blood seems to be profoundly altered, the digestive organs are interfered with, and the infant wastes and dies. 'Congenital syphilis,' 'mal-nutrition' is written on the death certificate of many syphilitic babies.

On the other hand those who suffer in a less severe form and come under treatment early rapidly improve, gain flesh, and for a time at least all symptoms disappear. While such cases may apparently be entirely cured yet, like the secondaries which occur in adults, the symptoms are very apt to re-appear, especially during the second and third year. This relapsed syphilis may make its appearance in children in whom the symptoms following birth are slight, and consequently what is really relapsed syphilis is very apt to be mistaken for acquired syphilis. This recurrence usually takes the form of condylomata or ulcerations about the anus or tongue, and chronic sores about the corners of the mouth and nose; various rashes may also be present.

During the next few years the child may remain fairly well, but on the approach of puberty symptoms which correspond to the *tertiaries* of adults may make their appearance. Children at this period often bear the marks of past lesions, and if seen for the first time there may be no difficulty in recognising them as subjects of congenital syphilis, as these flattened nose

and linear scars at the angles of the mouth, and typical pegged teeth, give them a characteristic appearance (fig. 83). They are apt at this time to suffer from periarthritis, caries of bones, chronic ulcerations, ulcers of the mucous membrane covering the hard palate, which may involve the bone; ulceration and destruction of the soft palate; various affections of the eye, as *iritis*, *keratitis*, *choroiditis*; various skin diseases, as *eczema*, *scabies*, &c.; gummata in the superficial structures, and also in the liver and other internal organs. Deafness and partial dementia may be present, the latter accom-



Fig. 83.—Congenital syphilis, showing flaccidity of bridge of nose, scum around mouth, and keratitis.

panied by syphilitic arteritis of the brain. In the worst cases the child may suffer for years from disease of one or other of the bones (figs. 84, 85, 86).

Having sketched the course of the disease, we may now proceed to describe some of the phenomena presented by congenital syphilis more in detail.

Skin.—*Periophigus* is one of the most characteristic of the syphilitic eruptions, and when present at birth may be taken as certain evidence of hereditary syphilis. The seat of the blebs in syphilitic *periophigus* is the palms of the hands and soles of the feet, but they may be present also on the extremities and trunk; their contents are purulent or sanguineous; they may be succeeded by deep ulcers. According to Roger non-specific *periophigus* is rare before three years of age, and most common after six years; the blebs are rarely numerous, do not occur on the palms of the hands or soles of the feet, and contain serum rather than blood or pus. The prognosis is bad in syphilitic *periophigus* if the infant is born with the rash; as a rule, the later

it appears, the better is the prognosis. The commonest rash in hereditary syphilis is a *macula*, which may take the form of a bright-red diffuse rash with a sharply defined edge surrounding the genitals, with perhaps patches of similar redness about the body or face, or there may be innumerable spots or maculae about the body, with a more diffuse rash on the sides of the feet. Its colour is at first a vivid bright red; in a few days it fades, becoming more of the tint of lean ham; the affected part then desquamates, leaving the skin smooth, shiny, and dry. The rash may be visible for weeks, assuming in its later stages a coppery colour. Instead of the macula, the rash may consist of *papules* of a bright red colour, which are confluent about the genitals and hamules, but scattered irregularly over the body. The rashes most likely to be confounded with a syphilitic roseola are those so commonly present about the genitals of infants, especially those produced



Fig. 14.—Complete Desquamation of the Skin.
Upper lip, and part of the Jaw in Congenital
syphilis, in a boy aged 15 years.

in dyspeptic children by the irritation of feces and wet napkins. The difficulty of diagnosis is very likely to arise in the absence of a characteristic rash in other parts of the body, or of creyza. It is needless to say that a red rash with excoriations and signs of irritation about the anus and genitals may occur in both syphilitic and non-syphilitic children, and no rash in this situation should be regarded as specific without confirmatory evidence elsewhere. *Pustules*, or *acne* rashes, *micules*, *furuncles*, and *cellulitis*, may occur in syphilis in infancy. Simple pruritus rarely occurs before the third or fourth year, while syphilitic acne rashes are not uncommon in early childhood, on the plantar and palmar surfaces, and on the face. Pustules followed by deep ulceration are not uncommon in rachitis.

Children apart from the effects of syphilis; thus occasionally in chicken-pox the vesicles are succeeded by pustules or bullae, and a deep ulceration is produced. In making a diagnosis several points must be borne in mind: syphilitic rashes mostly affect the genitals, palmar and plantar surfaces, and face; they are usually bright red at first, then dull red and more or less of a coppery hue; they are followed by free desquamation, and they cease itching. Different varieties may be associated together.

Macula patches and condylomata when present are of great diagnostic value; they may occur at all ages, but are especially common in infants in children of two or three years of age. These common seat is around or by the side of the anus, vulva, fold of the groin, corners of the mouth, entrance to the naris—less commonly the folds of the neck. They form where there is some irritation, where a surface of skin is fretted by some discharge and

kept constantly moist. Mucous patches may be present on the side of the tongue and soft palate.

Coryza is perhaps the most constant symptom present. The mucous membrane of the nose is swollen and congested, respiration is carried on with difficulty on account of the obstruction. The infant is very restless at night, waking at short intervals to get its breath. Lacr as a purulent discharge tinged with blood makes its appearance, which frets and irritates the skin in the neighbourhood, and ulcers and crusts form along the upper lip and side of the nose. Caries of the nasal bones may take place; there may be a discharge of pus, which makes its appearance down the nose and at the corners of the eyes.

Lesions of internal organs.—Parrot has pointed out that an ulceration due to syphilis occurs occasionally near the median line inside the lower lip; serpiginous ulcers occur on the tongue; inside the lips, near the corners of the mouth, on the gums and soft palate; they are mostly shallow, with a red and shiny base, surrounded by a raised, whitish, irregular border. Less often they are deeper and of a yellowish tinge. A peculiar degeneration of the tongue has been described. Deeply cut ulcers make their appearance on the hard palate in tertiary syphilis, the bone is quickly affected, and a communication with the nasal cavity established. A deep ulcer may form on the soft palate, and shortly a sharply cut hole be seen right through the velum palati. Laryngitis, mucous tubercles, and ulcerations along the edge and at the base of the epiglottis, occur, but specific lesions of the larynx are less common in children than in adults. Specific lesions of the lungs are not common, though syphilitic infants frequently die of broncho pneumonia. In the lungs of infants born dead, or dying soon after birth, granular and fluid exudations may be found, and a form of chronic pneumonia which has been described as white hepatization by Virchow. Patches of white hepatization may sometimes be found scattered through the unexpanded lungs of infants born dead, and the mediastinal glands may also be enlarged and inflamed in a similar way. The granular are most often seen on the surface of the lung and are apt to soften in the centre (Parrot). The *tricus-*



FIG. 10.—Congenital Syphilis. Distension of lower and upper extremities.

FIG. 11.—Congenital Syphilis. Distension of lower and upper extremities.

of newly born infants may contain gummata; these may be of variable size, perhaps in some cases as large as a shilling on the surface, perhaps extending in the centre; on section a diffuse infiltration may be seen. (See page 177.)

The **spleen** is frequently enlarged and indurated, especially where cachexia is a marked symptom, as pointed out many years ago by Leno. It is generally simply indurated, but tertiary gummata have been found.

Syphilitic disease of the **bones** may occur both early and late in the disease. Caries of the nasal bones may follow the coryza, leading to the filling in of the nose which is so common in syphilitic children; or the bones may be completely destroyed. Caries of the hard palate and turbinated bones, as well as of the long bones, more especially the tibia, may occur. In the latter bone caries may follow psoasical nodes; or thickening of the bone may be met with. Apart from caries a peculiar inflammation termed



FIG. 16. — Swelling of long ends of Tibia and Fibula, and also Radius and Ulna, from a syphilitic infant of four months old. The swelling lies on and about the line of junction between the epiphysis and shaft. (Compare with *Kidney Enlargement*, p. 211.)

syphilitic epiphysitis is apt to occur near the epiphyses in the long bones, especially at the lower ends of the humerus, femur, radius, and tibia in infants who are suffering severely from hereditary syphilis. The mother notices that the infant does not move an arm or leg so freely as the other, and it is painful as if it is acute pain if the limb is handled or moved suddenly. An examination of the end of the humerus, if the arm is affected, may show it to be swollen and tender, and the limb hangs useless, so that the term 'pseudo-paralysis' has been applied. (See fig. 85.) The epiphyses of several of the long bones perhaps show an enlargement where they join the shafts of the bones, and sometimes a slight effusion is present in the joint. More rarely the phalanges of the fingers are also swollen. The nature of this lesion has been studied with great care by Wegner, Parrot, Taylor, and Kapositz. Separation of the epiphysis from the shaft and the formation of an abscess may take place, though in this country the latter accident is rare. Lesions in the

cranial bones have been described by Wegner and Parrot; the former has found granular periostitis of the dura mater beneath the parietal bone, a possibility to be borne in mind when epileptiform attacks occur in syphilitic children; the latter has laid stress on the craniotabes found in syphilitic children, and also on the overgrowth of bone, forming bosses or osteophytes, on the surface of the frontal and parietal bones. To what extent either of these lesions is directly due to the syphilitic poison is uncertain; certainly craniotabes occurs in association with rickets, and is also seen in wasted infants in whom evidence of syphilis is wanting. [See chapter on DISEASES OF BONES.]

The osteophytic growths have been noted both in infants and older children; they consist of small rounded elevations of bone $\frac{1}{2}$ inch to 1 inch in diameter, most commonly situated near the longitudinal or fronto-parietal sutures, and can be felt by passing the hand over the infant's scalp. In some cases there is an excessive formation of bone at the frontal and parietal eminences, with furrows or depressions along the sagittal and fronto-parietal sutures, thus making a cross, as it were, on the vertex: the skull is then said to be *cruciform*. This condition also occurs in rickets.

The **teeth** of the second or permanent set are often misshapen and peculiar. The most characteristic changes are seen in the central incisors of the upper jaw; they are more or less dwarfed, peg-shaped—i.e. they taper inferiorly—slant towards each other, and have a central notch in their cutting edge; the other incisors may be more or less dwarfed and notched.

Affections of the eyes are most common about puberty, the commonest being interstitial keratitis, iritis, and choroiditis. The two former usually occur together, though they may occur singly. The first symptom noticed is watering and irritation of the corneal conjunctiva, then a steamy appearance or cloudiness of a portion of the cornea; this is followed by the formation of minute blood-vessels on the surface of the cornea, giving the steamy patches in some cases a reddish or salmon-coloured tinge. These patches join the sclerotic, are generally symmetrical, and are apt to relapse. Disseminated choroiditis may occur: in such cases small patches of atrophy of the choroid, of a white or grey colour, are generally seen scattered about the fundus of both eyes; pigmentation is frequently present; there is often the remains of a past iritis and neuritis.

Ears.—Gradually increasing deafness, which is often very intractable to treatment and depends on labyrinthine mischief, is common in congenital syphilis. It usually appears at about the same age as interstitial keratitis, i.e. from the seventh to the fifteenth year, but occasionally begins much later. Complete deafness frequently results from this affection. The three lesions of the tooth, the cornea, and the ear are known sometimes as 'Hutchinson's triad' of symptoms, and may be looked upon as quite pathognomonic. Middle ear disease is also sometimes caused by congenital syphilis.

Brain.—Granuloma are rare in the brains of children; they have been observed by Henssch in a child two years of age on the surface of both cerebri and cerebellum, and T. Barlow has described multiple syphibomas at the base of the brain, with thickening of the arteries. Chronic meningo-encephalitis, giving rise to idiosy, may occur, as may also chronic hydrocephalus (see pp. 452 and 455).

Diagnosis.—This is often difficult and sometimes remains uncertain. In the infant case must be taken into mistake, as students are very apt to do, an erythema about the genitals, which has its origin in the irritation caused by soiled napkins, for a specific rash, or, on the other hand, hastily to assume that an infant is *not* syphilitic because there is a certain amount of excoriation and redness about the anus caused by the fretting of the wet napkins. No rash can be taken as characteristic which is not present in other places as well as about the genitals, out of reach of the irritating effect of the urine or feces. Coryza in an infant a few weeks old is exceedingly suspicious, especially in the absence of signs of catarrh of the bronchial tubes or lungs, and if it remains chronic is probably syphilitic, even though a rash may now be present. Tenderness and swelling of the epiphyses of the long bones in an infant are strong evidences of syphilis; yet much no importance is cranial-tubercles, or bones on the cranial bones, or the sutureal skull, as they may be undoubtedly present in rickets and perhaps other conditions. Syphilitic epiphysitis can hardly be mistaken for the enlargement of the epiphyses present in rickets. In syphilis the swelling is situated between the epiphyseal line and the shaft (see fig. 35), while in rickets the swelling involves the epiphysis itself (see fig. 36). Syphilitic thickening occurs in infants of six weeks to three months old, while the rickety enlargement is rarely seen before six months of age, and more commonly at a year or eighteen months of age.

Treatment.—In all cases where the parents are known to have suffered from syphilis, or some older child has been affected, antisyphilitic treatment must be commenced without waiting for the development of symptoms, in the hopes of mitigating the disease or of preventing its development. The anti-syphilitic treatment of the parents who have had syphilitic children forms an important part of prophylactic management, and may prevent the transmission being transmitted from the mother to the fetus. In the treatment of infantile syphilis it should be borne in mind that the effects of the poison are apt to impair the functions of almost every organ in the body, and in the worse cases there is a marked tendency in the direction of anemia and gastro-intestinal atrophy. The diagnosis of the syphilitic infant requires the most careful attention, especially if it has to be artificially fed, as such infants are exceedingly likely to suffer from aggravated dyspepsia and mal-nutrition. It should, if possible, be suckled by its mother; if this is impossible it must be artificially fed, as a wet-nurse is not permissible on account of the danger of her becoming infected by the nasal or other discharges from the infant. As soon as the diagnosis is made or the disease suspected, mercury must be given in some form or other. The usual plan is to give mercury and chalk-powder in half-grain doses twice a day, this form of mercury being used on account of its mildness and its being less likely to disturb the bowels than calomel. If any looseness of the bowels follows its administration, it may be combined with a grain of chalk and opium powder or the compound cinnamon powder. In a few weeks the dose may be increased from half a grain to a grain; this treatment should be continued as long as any of the special symptoms are present, or for some six weeks or two months, when the mercury may be omitted for a fortnight or so, and the syrup of iodide of iron in five to ten drop doses may be substituted.

If there is breath-tachæmia or mal-nutrition, a few drops of cod liver oil may be added. Instead of the mercury and chalk some prefer to give calomel in one-sixth to one-half grain doses combined with half a grain of saccharated carbonate of iron. In Vienna a combination of mercury and tannic acid is used (*Hydrag. tartaricæ oxydlatum*) when other mercury salts disturb the bowels; the dose is the same as calomel. In obstinate cases, especially where the skin eruptions are chronic, sublimate baths as recommended by Baginsky may be used with good effect. A bath may be taken daily in which ten grains of corrosive sublimate are dissolved; the child should remain in the bath some five minutes, care being taken that none of the water gets into its mouth. The baths are more cleanly than and preferable to the friction of blue ointment, and act with greater certainty. During the time the infant is taking mercury the gums should be carefully watched, and any signs of stomatitis or spanginess about them should be the signal for at once discontinuing all forms of mercury. It is, however, very rare for salivation to occur in children. The coryza should be treated, when the obstruction or secretion is excessive, by injections of weak solutions of nitrate of silver (gr. i. ad ʒi. or boric acid); the dried secretion should be removed, and any soreness and excoriation about the nose or lips should be treated with yellow oxide of mercury ointment, which may be applied on a small camel's hair brush. Boric acid may be applied locally as a dusting powder to the rash about the genitals or elsewhere. During the relapses mercury should be given in some form or other, and the anorexic patches and condylomata which so frequently accompany relapsed syphilis should be frequently dusted with finely powdered calomel. In the latter stages, during the tertiary symptoms the solution of bichloride of mercury in doses of half a drachm to a drachm, combined with iodide of potassium, should be given and continued for many months, when the syrup of iodide of iron may be substituted. Tertiary syphilis is apt to be very chronic; the ulcerations of skin and canes of nose and corneal affections remaining for months nearly stationary, and quickly relapsing when treatment is suspended. Iodoform and the yellow oxide of mercury ointments are the most useful local applications for the skin and conjunctiva, while a solution of nitrate of silver (gr. x ad ʒi.) may be used as an application to the specific ulcerations of the mouth and palate. During the treatment of syphilis, both in infancy and later childhood, the most generous diet which can be digested must be prescribed. Abundance of fresh air and change must be insisted on, and the most scrupulous care taken to promote cleanliness and to prevent any non-syphilitic individual from becoming infected by any discharges from the patient.

The mercurial treatment should be resumed after a fortnight's or three weeks' interval, even if all the symptoms have disappeared, and it should be continued for at least six months.

In some cases of late congenital syphilis healing of ulcers or bone lesions will only be procured by the use of very large doses of iodide of potassium, either alone, or, better still, in combination with mercury. We have had to order twenty-grain doses of the iodide three times daily for a boy of about twelve before any material improvement was effected.

CHAPTER XX

DISEASES OF THE NERVOUS SYSTEM

Introduction.—The student who has gained his knowledge of the diseases of the nervous system entirely among adults, will be certain to find, when he comes to see the same class of diseases among children, that the difficulties of diagnosis are much greater in the latter, and that some diseases which are rarely met with among adults are common enough among children. This is no doubt true of disease in children generally, but it is especially true of the nervous system. For instance, he will find very early in his career that it is often exceedingly difficult to estimate the amount of pain from which a child or infant suffers. An infant or peevish child will cry from fear, discomfort, or bad temper just as loudly as from the severest pain, and it may be quite impossible to localise the seat of pain or, indeed, to find out what it is crying for. There may be a general hyperæsthesia *pæne*, but it will be mostly very unsafe to draw any conclusions from this symptom alone as to the presence of organic disease, though it may be borne in mind that hyperæsthesia is frequently present in the early stages of meningitis. The infant's legs may hang down helplessly, and he may at first think that they are paralysed, but a closer examination may disclose the fact that there is some epiphyseitis or perivisceral tenderness which has prevented the child from using the limbs. On account of the readiness with which reflex disturbances are evoked in the young, we often find ourselves in difficulties and in error. Thus the infant has convulsed convulsions; are these due to a serious lesion on the opposite side of the brain, or to an intestinal catarrh or colic? How often the differential diagnosis between gastric and cerebral vomiting in infants is difficult and for a time impossible! The nervous system of the young is easily upset by a high fever or a poisoned condition of blood, and there may be drowsiness, retraction of the head, and convulsions—symptoms which naturally suggest cerebral diseases such as meningitis.

Among the diseases which are much commoner in the young than in the old, meningitis stands pre-eminent, and assumes in consequence a position of great importance. It occurs alike in apparently healthy and robust infants and children, and in those whose history and symptoms suggest tuberculous in some of its phases. Cerebral hæmorrhage from a ruptured artery is rare in the young, but an extensive bleeding may take place on the surface of the brain from over-distended veins or capillaries, and give rise perhaps to a bilateral hemiplegia. Convulsive disorders—the spasm being local or general—are vastly more frequent during the first two or three years of life than at any other period, and their results much more serious

The infant may die in a convulsion from spasm of the glottis, or a meningeal hemorrhage may take place, and a serious injury to the brain may be thus caused. Among other diseases which are of greater frequency in early than in later life, acute atrophic paralysis and chorea may be mentioned.

Clinical Examination.—The shape and size of the skull are of importance as giving some indication of the size and configuration of the brain. The condition of the skull may be investigated by inspection, palpation, and mensuration; neither auscultation nor percussion yields any indications of much practical importance. By inspection a general idea may be obtained of the shape of the head, whether large (macrocephalic), small (microcephalic), asymmetrical, long (dolichocephalic), as in the negro, round (brachycephalic), as in the Mongols, hydrocephalic, or square, as in rickets. By means of palpation the condition of the fontanelles can be ascertained, whether bulging, as in hydrocephalus; or depressed, as in anæmia; or widely open for the child's age, as in rickets. The edges of the bones may be felt to ascertain if they are thickened; the parietal or frontal eminences may be usually prominent, or rancous bosses may be present, as pointed out by Paron. Undue thinness of the skull, more especially of the occipital, may be detected by firm pressure with the fingers, the bone being felt to bend or yield beneath the fingers. By means of mensuration, using calipers and a thin flexible piece of lead wire, a tracing of the outline of the skull, both longitudinally and transversely, may be made, and a graphic record, thus made, kept. In this way the frontal or occipital regions may be shown to be smaller than normal, or one parietal region may be flatter than the other, as in some cases of deficient development or injury at birth.

The clinical examination will necessarily include observations on the condition of the muscles to see if any paresis or paralysis is present. A slight squint is easily overlooked, and the friends may have to be appealed to for their observations, as the squint may be present at one time and absent at another. The condition of the pupils must be observed, and it may be necessary to examine the optic discs and to test the refraction of the eyes. If there is any question of paralysis, the child should be examined when naked, and if it can walk, the character of its gait observed. The condition of the reflexes, especially the knee-reflex, and the presence or absence of ankle-clonus observed. An exaggerated knee-reflex with ankle-clonus is usually present in old cases of 'birth paralysis,' and in pressure palsy when the disease is situated above the lumbar enlargement. But these phenomena are certainly also present in some cases of hysterical paraplegia, especially when the paresis has lasted some time. We have twice seen exaggerated knee-reflex, both times in boys, following an ill-defined feverishness, lasting several weeks, and finally ending by completely disappearing. The absence of knee-reflex suggests peripheral neuritis.

Ankle-clonus is often also seen in old standing disease of the tibia when the leg has been in splints.

Cerebral Congestion.—A passive congestion of the venous system inside the skull takes place whenever respiration ceases or is impeded, in consequence of an over-filling and distention of the right side of the heart. This is markedly so during a convulsion and in acute general bronchitis. Does an acute active congestion take place without passing on into an acute

meningitis? This question is difficult to answer. Certainly there are cases which suggest this. Thus we have seen school children, both boys and girls, who have been working hard at examinations, suffer from headache, vomiting, prostration, rigidity of the muscles of the neck, *opisthotonus*—symptoms which suggest cerebral irritation or an early stage of meningitis—recover entirely, after a few days' rest in bed, under the influence of bromides. We must not, however, forget that any symptoms of cerebral irritation in the young are extremely suggestive of a primary tuberculous of the arteries of the brain, which may be followed at any time by the symptoms of meningitis.

Meningitis

Tubercular Meningitis.—In tubercular meningitis there is an inflammation of the pia mater, set up by the presence of tubercles on the vessels, more especially at the base of the brain. While tubercles and meningitis are very commonly found associated together *post mortem*, it must be borne in mind that a simple non-tubercular meningitis is not uncommon, and also that tubercles may be present on the vessels without any meningitis, though the probabilities are great that if tubercles are present they will sooner or later light up inflammation of the meninges. Another point must also be remembered: that a meningitis so called is in reality a meningitis-encephalitis; the vessels which penetrate the grey matter of the convolutions are certain to join in the inflammation.

Tubercular meningitis is less common in children under the age of one year than in older children; simple or purulent meningitis is perhaps relatively more common at this period, though the tubercular form certainly does occur, but on account of the difficulty of distinguishing between simple and tubercular meningitis in infants and young children we are rarely justified in making a differential diagnosis in the absence of a *post-mortem*. Between the age of one year and the commencement of puberty tubercular meningitis is a common disease.

It rarely happens that the pia mater is the first part of the body to become the seat of tubercle; a tubercular meningitis is in the large majority of cases preceded or at least accompanied by grey granulations or caseating tubercle in some other part of the body. A tubercular meningitis is often the closing act of a general tubercular process; it may occur early in life, and, when once established, quickly brings the end. The *post-mortem* evidence of this is clear and decisive, for in the bodies of those dying with tubercular meningitis grey granulations or caseating tubercle will almost certainly be found in the lungs, bronchial glands, brain, spleen, or other organs. Clinically the same thing is also evident; children suffering from hip-joint disease, spinal caries, caseating cervical glands, or chronic tubercular peritonitis, are not infrequently cut off by an insidious attack of tubercular meningitis, or the latter follows whooping-cough, measles, or pneumonia. In the large majority of cases there is a definite history of ill-health before the actual brain symptoms supervene. An exception to this is, however, seen in the case of infants and children under two years of age, in whom occasionally the attacks are sudden, supervening in the midst of apparent health.

What determines the growth of tubercle on the pia mater and the tubercular meningitis? No certain answer can be given to this question. It is easy, and perhaps natural enough, to attribute it to over-excitement of the brain, or excessive brain work; and possibly this may be so in some cases in tubercular children, who have been badly fed and subjected to unfavourable conditions, while their brains are being driven at the highest pressure; but such cases must be exceptional. It must be borne in mind that tubercular meningitis attacks children a few months old and children in hospital, and under conditions in which it is impossible that over-brain work can have had anything to do with the supervention of the meningitis. We cannot say why the tubercular process should in one case attack the brain and in other cases the peritoneum, pleura, or lungs.

Symptoms and Course. Preliminary.—The onset is insidious and the early symptoms are ill-defined, being those of general malaise rather than of actual disease. In most cases there is a history of ill-health for several months, perhaps succeeding an attack of measles or whooping cough, during which time the child has wasted or lost flesh and become flabby. There may have been cough, dyspepsia, constipation, loss of appetite, otitis, enlargement of glands, or more or less feverishness, especially at night; such symptoms are not in any way distinctive, and are often the result of a chronic intestinal or gastric catarrh; yet, if there is a family history which suggests tubercle, they necessarily excite suspicion. In some cases definite brain symptoms precede by many weeks the actual attack of meningitis, and then perhaps pass away or remit for a while. Among these may be mentioned headache, squint, a staggering gait, an unusual tendency to fall, a temporary loss of control over the sphincters. The *Lancet* Dr. Osley records a case in which the boy's disposition entirely changed, and he showed a constant tendency to bite on the least provocation; often there is extreme irritability, which is all the more suspicious if it occurs in a good-tempered child. Such symptoms are possibly due to the irritation caused by the presence of tubercle on the vessels or in the brain, which may perhaps precede for some time the attack of meningitis; or it is quite conceivable that a temporary congestion or even a patch of meningitis may be present.

It is impossible during the preliminary stage to do more than suspect the onset of tubercular meningitis or tuberculous in some form or other; in a large number of such suspected cases recovery gradually takes place without any definite diagnosis having been arrived at; in these cases, however, we are hardly ever warranted in assuming that our treatment has been the means of wounding off an attack, and we may be left in ignorance as to its nature. In some cases, especially in infants, there are no preliminary symptoms: the child, while in apparent health, begins to vomit and gradually becomes comatose, or about the first symptom which attracts attention may be a hemiplegia. In such cases a simple meningitis is perhaps suspected, but the *post-mortem* usually shows it to be tubercular.

The preliminary symptoms gradually pass into the first of the three stages into which the attacks are usually divided—namely, the *stage of excitement*. At the commencement of this stage the symptoms may be chiefly gastric, or they may be definitely cerebral from the first. In the former case the most prominent, and indeed sometimes for several days the only

symptom, is vomiting. This may begin after a meal and be attributed to some improper food, but it continues in spite of the most careful dieting, is usually accompanied by a clean tongue, and, while aggravated by food, often recurs, with much retching and nausea, when the stomach is empty. Too much stress must not be laid on the character of the vomiting, and perhaps for a few days a doubt may be entertained as to its true nature, whether due to cerebral disease or gastric irritation. The vomiting of meningitis is usually cratic, coming and going without any apparent cause. At this stage the child may be perfectly intelligent, and no direct cerebral symptoms may be present. Constipation is usually present: the abdomen, which is at first rounded, becomes flabby, and later retracted, from the contractions of the intestinal walls which takes place. Before long other symptoms, more directly pointing to the brain, become developed. There are headache, giddiness, great irritability, intolerance of light and noise. The child likes to be nursed by his mother, lies on her lap, and resists the interference of others. Its temper has completely changed: it is feverish and extremely irritable.

The symptoms may be more definitely cerebral from the first, and the vomiting may not be a prominent symptom. The child complains of headache, which is often intense; there is giddiness and staggering gait; its sleep is disturbed by dreams, or it wakes up with a shrill cry of distress, often of a piercing character, and known as the 'hydrocephalic cry.' The child neglects its toys, preferring to be quiet and undisturbed. The pulse is usually quickened, the temperature raised a degree or two at night, and the tongue becomes coated with fur, which has often a brown or yellowish tinge. Remissions are apt to occur, and for a while perhaps the little patient is again himself, bright and chatty, and ready for his toys, but to the disappointment of the friends the old symptoms return with greater intensity. So far the symptoms have been those of cerebral excitement, caused in all probability by the inflammatory congestion of the pia mater which is present; following this, comes the stage in which effusion is taking place and the brain functions become more and more effaced.

The *second stage*, often called the *stage of transition*, is marked by the commencement of drowsiness. The child becomes more and more dull and heavy; it is no longer fond on its mother's lap, but in bed, in a half-drowsy state. It likes to lie quiet, does not wish to be disturbed, and if roused it answers in a snappish manner and then curls up again and is off to sleep. The vomiting now is usually less urgent or perhaps ceases: the abdomen is retracted, the bowels confined. The pulse is usually slower than in the earlier stages, and is frequently irregular and hesitating. Commencing optic neuritis may be observed, but the child in this stage will often keep its eyes spasmodically closed, so that observations on the discs are rendered difficult. The edges of both discs appear blurred and indistinct, from the presence of swelling: the veins become distended and tortuous, but the changes are never so marked as they are when a cerebral tumour is present. The intensely congested and swollen discs, with various minute hemorrhages so often seen in other forms of cerebral disease, never occur, possibly because there is not sufficient time for these extreme changes to develop. Military tubercles may be present in the choroid, but these—as far, at least, as our experience goes—are only present in cases of general military tuberculosis.

Various other phenomena are apt to supervene, such as convulsions, muscular twitchings, paralyses, and spastic contraction of the muscles of the neck and back, less often of the limbs. The convulsions may be general and bring about a fatal result, especially in young children. The paralyses may involve the muscles of the eye, face, or limbs of one side. Retraction of the head is very common: it is sometimes so extreme that the back of the head comes in contact with the spine; the back is frequently arched. There is often a spasmodic contraction of the masseters, so that the child grinds its teeth, making a peculiar and unpleasant grating sound. There is apt to be incontinence of the urine and feces. As the child becomes more and more drowsy the respirations become altered in character, approaching the 'Cheyne-Stokes' type—i.e. the respiratory movements become shallower and slower, until they cease; then a distinct pause in the respirations takes place, to be followed by a deep, sighing inspiration, which is again followed by a series of shallow respiratory movements, or the pause is followed first by shallow then by deeper respirations, as in fig. 57.

From a condition of drowsiness the child passes into the *third stage*, or stage of coma. It can no longer be roused or recognise its friends; the conjunctivæ become insensible, the pupils dilated and sluggish, and now the

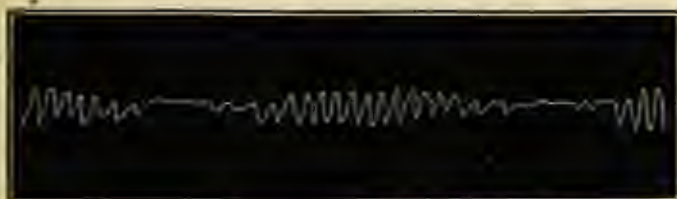


Fig. 57.—Tracing of Movements of Chest Walls from a case of Meningitis, showing 'Cheyne-Stokes' respiration. (After Lambolt and Stilling.)

optic discs can be examined without difficulty. The muscles of the limbs and abdomen are now weak, flabby, and toneless. The tongue is now coated with a thick brown fur, and sores appear on the teeth and black crusts on the lips. The skin is harsh and dry, and the wasting becomes extreme. Excessive secretion takes place from the conjunctivæ, so that the eyes become smeared with mucus or pus. The pulse becomes weak and rapid. The coma is usually profound, so that the child cannot be roused even for a moment, but usually the power of swallowing is retained to the last. In this miserable condition the patient lasts for many days, perhaps a week, and even after it appears moribund slight improvement may take place. The total duration of the disease is usually about three weeks, but, especially in young children, death may take place much sooner.

The temperature throughout the course is most uncertain, but always of an irregular, intermitting type, sometimes varying three or four degrees during the twenty-four hours; at other times the fevers are much less marked. The temperature is of course modified if there is an extensive tubercular process in progress in the lungs and other parts. Hyperpyrexia is not uncommon; in one case that of a boy of three years of age, who was convulsed, the temperature

rise to 108° F. (rectal temperature) shortly before death. The *post-mortem* showed tubercular meningitis, caseous mediastinal glands and some milary tubercles in the spleen and kidneys. The lungs were free. The paralysis which are apt to occur are seldom marked, often only temporary, being rather paretic than paralytic; sometimes, however, when extensive softening takes place in one hemisphere from thrombosis of some large vessel, the paralysis of an arm, or arm and leg, may be complete. Anesthesia is rarely, if ever, present; hyperesthesia is not uncommon in the early stages, but more as a part of a general irritability than anything else.

While in typical attacks the various stages are fairly well marked, cases are frequently met with which are extremely irregular, where the typical symptoms are absent, and no diagnosis is made until the child is comatose and moribund. In such cases the symptoms may be indefinite for a week or ten, then a marked improvement takes place, which gives hopes that our diagnosis of meningitis is incorrect, when suddenly convulsions and coma supervene and death speedily occurs. The fact that a remission of many of the symptoms may take place, the child being decidedly improved for a while, must be constantly borne in mind. In other cases the course is short and sharp, in this respect resembling some cases of simple meningitis. Thus, for instance, a boy of eight years, who came of a tubercular family, attended at school till April 25, though for the last few days he had not felt well. He then stayed at home on account of cough and weakness; he began to vomit on May 3; the next day he became drowsy, gradually passing into coma, and died on May 5. At the *post-mortem* milary tubercles, with some pneumonia, were present in the lungs and in the abdominal organs; there was also tubercular meningitis, with much fluid in the lateral ventricles and subarachnoid space.

In infants of six months and under the symptoms are often the reverse of characteristic: the infant perhaps vomits food, but in other ways appears quite well, and the vomiting is not unattractively looked upon, as due to some gastric irritation; then perhaps some rigidity about the muscles of the neck and slight retraction of the head are noticed, and the infant gradually passes into a condition of drowsiness and coma. Muscular twitchings of the facial muscles or frequent clonic spasms of the muscles of a limb or arm may be present. In other cases the infant appears to be 'thriving,' there is some slight fever and restlessness, but nothing to indicate cerebral disturbance; then suddenly convulsions come on, followed by paralysis of an arm and leg, and perhaps coma. The state of the fontanelle is often a help in diagnosis in doubtful cases, as is also the rigidity of the muscles of the neck and consequent retraction of the head. The fontanelle is full and bulging, and in the later stages the veins on the forehead may be more prominent than usual, and the head may actually enlarge from the presence of an excess of fluid in the lateral ventricles. The retraction of the head is not diagnostic, it occurs in cases of chronic meningitis, and sometimes it appears to be the result of reflex irritation from the pulmonary and abdominal viscera. Hutton has noted it in a case of commencing pneumonia in an infant. It occurs also in otitis.

Simple Meningitis.—Simple meningitis is not so common a disease as tubercular, though it doubtless is more common than is usually thought, as

there is little doubt that it is often mistaken for the tubercular variety; indeed, it may be quite impossible to distinguish one from the other during life. It is perhaps most common during the first and second year, though it is by no means confined to these periods. It may be idiopathic, arising without any discoverable cause; there is, however, often a history of a fall or blow on the head, and it is also apt to supervene during an attack of pneumonia, pneumonia, or typhoid fever, or to arise from an otitis, or from caries bone in other positions. It appears to occur in hot weather, especially after exposure to the sun. It is said also to occur in the course of diphtheria and erysipelas. We have once seen it in scarlet fever, death taking place on the twenty-first day, but unfortunately there was no *post-mortem*, and, as the girl had also had discharge from both ears, it was possibly due to an extension of the inflammation from the tympanum to the meninges of the brain. It occurs both sporadically and also in epidemics, in connection with meningitis of the cord or cerebro-spinal meningitis. Syphilis is a cause of meningitis, but this is rarely acute; it gives rise to a chronic basal meningitis, or a local meningitis in the neighbourhood of a granula.

Symptoms.—It is unnecessary to discuss the symptoms of simple meningitis in detail, inasmuch as they closely resemble those of the tubercular variety; it will be more useful to point out the typical forms in which meningitis occurs.

Acute Form.—In some cases, both in infants and older children, the attack may run a very acute course, death from convulsions taking place in two or three days. The acute meningitis in some of these cases is associated with a pleuropneumonia or peritonitis. As an instance of rapid death from what was probably an acute meningitis, though the *post-mortem* examination showed no effused lymph, the following case may be taken as an example:

Acute Meningitis.—Destree E., aged 3½ years, was a healthy child till six months ago, when she was taken with pain in the head, fever, and vomiting, but recovered in a day or two. Two days before admission, when playing in the street, she ran in, complaining of pain in the head, and vomited; she continued to vomit constantly for two days; she died six days before admission. There had been no injury to the head; the weather was hot at the time (August). On admission she looked ill, her face having an expression of anxiety; two hours after admission she was convulsed and died. Her temperature was not taken. At the *post-mortem* all the organs were healthy, the capillaries of the brain were immensely injected, and there was much clear fluid in the lateral ventricles; the arachnoid membrane was somewhat opaque.

In this case microscopical examination showed that the capillaries of the meninges and grey matter of the brain were distended and gorged with blood, and though it cannot be certainly assumed that this congestion was primary and inflammatory, there is a strong probability that the case was one of acute inflammatory congestion of the brain and meninges. Similar cases of rapid death from acute hyperæmia of the brain after exposure to a hot sun are recorded by Lewis Smith and Boltman. Hensch mentions a similar case in a girl of five years, the attack beginning in the same way with headache and vomiting, death taking place within forty-eight hours, preceded by convulsions and coma. At the *post-mortem* a purulent exudation was present on the convexity and at the base of the brain.

In the following case meningitis supervened on acute diarrhoea :

Acute Diarrhoea, Meningitis.—Anne B., aged 34 years, was seized with vomiting and purging (in August) ; the next day, when admitted, she was in semi-collapse condition. A few hours afterwards she lapsed into unconsciousness. She was delirious, and there were muscular twitchings. Death took place rather suddenly at the end of the second day of the illness. At the post-mortem the pia mater was much congested, the arachnoid opaque, the Spinaa lutea were glued together with lymph, there were no tubercles; there were patches of congestion in the intestines and communicating plexuses of the base of the right lung.

These extremely acute cases are exceptional, and a doubt may often surround the diagnosis, as acute meningitis in the early stages may with difficulty be distinguished from the onset of some systemic disease, as scarlet fever or typhus, or perhaps more likely of pneumonia; and if the course terminates early in a convulsion it may be impossible even at the *post-mortem* to say with certainty what has been the exact nature of the case. Death from a convulsion, accompanied by spasm of the glottis, gives rise to a mechanical engorgement of both lungs and brain, and caution is required in positively asserting that an early meningitis or pneumonia is present.

In the majority of cases acute meningitis runs a course of a week or ten days, the symptoms resembling those described under tubercular meningitis. There may be a history of an injury, or of a past otitis, or of exposure to the sun, or positively of excessive brain-work. The early symptoms are those of intense headache, with injection of the conjunctivæ, vomiting, delirium, strabismus, and often high fever, perhaps as high as 103° to 105°. Later, the pulse becomes slow and hesitating, the abdomen is retracted, the ocular muscles are rigid, and Cheyne-Stokes respiration, coma, and various paralysis ensue. At the *post-mortem* a more or less intense, perhaps purulent, meningitis is found affecting the convexity and base of the brain.

Subacute Form.—In other cases the symptoms are less intense and the course longer. Infants are often the sufferers in these cases. The meningitis may be secondary, coming on in the course of other diseases, as, for instance, broncho-pneumonia; instead of the infant improving, as was expected, cerebral symptoms, such as vomiting, drowsiness, retraction of the abdomen, and cervical opisthotonus, make their appearance. The infant may remain for weeks in a semi-comatose condition, being able to swallow, and at times perhaps appearing sensible and recognising those about it; it gradually wastes, the cervical opisthotonus becomes extreme, possibly the legs fling up, the head enlarges, bed-sores form, and the child dies convulsed. At the *post-mortem* the base of the brain, including the pons and cerebellum, is found glued to the base by organising lymph, the lateral ventricles are extremely distended, the choroid plexus dilated and covered with lymph, and possibly the aqueduct of Sylvius is occluded. In such cases the possibility of the meningitis being due to syphilis must be borne in mind.

The following case may be taken as an instance :

Acute Meningitis, Hydrocephalus.—E. P., aged 7 months; no history of syphilis. At 6 weeks of age had an attack, during which he was almost crying and throwing his head back. A month ago he became drowsy and sick, and had twitchings of right arm and leg. He is unable to see. Admitted June 13. Constant vomiting; abdomen retracted; limbs

right knee joint; fingers are fixed. From June 13 to June 25, when he died, he was comatose; there was remarkable hypopyrexia; the temperature rising on succeeding days to 100° F., 101° 8, 102, 101° 4, and 101° 8 before death. *Post-mortem* showed lymph nodes confined to the interpeduncular space, pons, and base of cerebellum. Lymph nodules contained fluid and lymph; arteries thickened to about 1 inch in thickness from normal persons.

A subacute meningitis may occur in older children, and recovery from such attacks apparently takes place. Thus in a case of our own—that of a boy who died suddenly in apparent health, and on whom a coroner's inquest was held—an acute hydrocephalus was present, with some adhesions between the brain and the skull, apparently the remains of a meningitis from which there was a history of the boy having suffered some months before.

As an example of a simple subacute meningitis following an injury, the following case of Dr. Hinton's may be referred to:

Acute Meningitis, Hydrocephalus.—William C., aged 8 years, fell into a well, striking the back of his head, some three months before admission. He went off and on for 2 days or so, but did not lie up; he suffered from pain in the back of his head almost immediately after the fall. He was admitted with squint and pupils of unequal size; he had convulsions, optic neuritis, and lapsed into a semi-comatose state with Cheyne-Stokes respiration. He died twenty-four days after admission. At the *post-mortem* the dura mater was thickened and congested, there was much lymph at the base and between the hemispheres, and also between the latter and the cerebellum; the lateral ventricles were much dilated and distended with serum. There were no tubercles anywhere.

The following case illustrates the association of subacute meningitis and hydrocephalus with pneumonia:

Acute Meningitis, Hydrocephalus, Chronic Pneumonia.—M. V. R., aged 3 years, was always a healthy girl till seven weeks before admission, when she had an attack of bronchitis and vomiting; she has vomited more or less ever since; she has also been losing flesh. On admission she was drowsy and listless; screaming when disturbed with a shrill cry; the head was thrown back, the neck retracted; there was no optic neuritis. A few days after she had two fits. She continued to vomit at frequent intervals. There was much rigidity of the muscles of the neck, with the head thrown back; the hands and arms remained normal, while the legs and knees were fixed and the abdomen retracted. Later she suffered from double pneumonia in the bases, she wasted more and more, gradually became incoercible, and died ten or eleven weeks from the commencement of her illness. An examination of the brain showed that the Sylvian fissures were matted together with fibrinous adhesions; similar adhesions were present in interpeduncular space and surrounding the third and fourth nerves; fibrinous adhesions were also present on the upper surface of the cerebellum. The lateral ventricles were much dilated and distended with fluid; there had also been an inflammatory condition of their lining-membrane, with evulsion of fibrin. There was no tubercle anywhere; there was a double pneumonia becoming chronic.

Cerebro-spinal Meningitis.—Cases in which an inflammation of the meninges of the cord is associated with meningitis occur both sporadically and in epidemics. Sporadic cases are not uncommon, especially in infants; epidemics are rare in this country, but limited outbreaks have occurred in Dublin and Glasgow. The symptoms of cerebro-spinal meningitis in infants closely resemble those of simple meningitis, but usually there is more marked rigidity of the cervical muscles and muscles of the spine, the legs may be rigid and drawn up, and there may be more or less rigidity about the muscles of the arm and forearm. Sometimes there is opisthotonus resembling tetanus.

In older children pain in the back and limbs may be complained of, being more especially referred to the back of the neck or sacrum; sharp shooting pains may be complained of in the limbs. There may also be general hyperæsthesia. In the epidemic form purpura and hæmorrhagic eruptions are common. Pneumonia is a common complication. The diagnosis between cerebral meningitis and a cerebro-spinal meningitis in infants is very difficult, often impossible, as it is difficult to localise pain and to arrive at a conclusion as regards a general hyperæsthesia. Retraction of the head and neck is less rigidly in the limbs may be present in both, but they are most marked when the spinal meninges are affected. Both tetanus and trismus may be mistaken for it; in the former there is marked trismus before the onset of the opisthotonos, and the temperature is normal or only slightly raised; and in the latter the peculiar spasm of the muscles of the head and jaw, and normal temperature, suffice to distinguish the two diseases.

Latent Form.—Meningitis, like peritonitis and pleurisy, may be present without giving rise to any very definite cerebral symptoms; this is especially so when it occurs secondarily, and the symptoms to which it gives rise may be overshadowed by the primary disease. It may occur in association with acute pneumonia or pericarditis, or acute intestinal catarrh, without its presence being suspected, partly because the headache, delirium, and other anomalies attendant on the more obvious disease present, and there is necessarily a difficulty in unravelling the complex association of symptoms and referring each to its cause. In some few instances a meningitis may exist without there being any cerebral symptoms whatever, as in the following case:

Paralysed Meningitis.—An emaciated child (son of a yeoman of age, who had recently suffered from a whooping cough, was admitted to hospital with some stiffness at the base of the lungs. There was a history of diarrhoea, and during the fortnight preceding his death he had had five or six marbled stools daily. There was a hectic temperature, no vomiting, hoarseness, or aphæria-mouth; he was perfectly intelligent, and died apparently of exhaustion. It was supposed that there was general tuberculous. At the post-mortem the lungs were found adherent to the diaphragm; some irregular pits were found present at the hilum, evidently the remains of a small suppuration; there were no tubercles seen. There was some purulent lymph covering the inner surface of the first water, the inner surface of the lungs, and the vessels in the transverse fissure, and filling the sulcus of the lateral ventricle; the base of the brain was coated with lymph. There was clear fluid in both tympanic cavities, but no pus.

It is in young, anæmic children that such lesions as purulent meningitis, pleurisy, or peritonitis may exist without giving rise to marked symptoms.

Prognosis.—As soon as a diagnosis of tubercular meningitis is made there is little hope of recovery. In any case the hope must be rather that our diagnosis is wrong than that a permanent recovery can take place from tubercular meningitis. Yet undoubtedly the meningitis produced by the presence of tubercle does not always kill at once, and, moreover, in any case there is the hope that the meningitis is a simple one without the presence of tubercle. We have seen at least three cases—in which there was good evidence to show that they were suffering from tubercular meningitis—recover for a time and die subsequently of a second attack or of a general tuberculosis; one of these cases may be shortly referred to.

Tubercular Meningitis. *Youngs's Nancy*—May 8, aged 3½ years, was convulsed all a month or two before admission to hospital, when several "cold attacks" ensued on her legs and discharged. Lastly she has had nocturnal, then giddy, staggers in her gait, and vomited at night. For several nights after admission she was restless, and vomited with pain shooting through her head; one interval a good deal was noted in the left eye; she was fairly restless in the daytime, but complained of headache, and frequently pressed her fingers under her eyes; there was occasional vomiting. She walked well some two or two hours and completely lost to bed, and tremulous. There was slight tonic spasm, which gradually subsided during her stay. She gradually improved, and was discharged after a three months' stay, apparently quite well. She was readmitted six months after with unmistakable signs of meningitis, and died after a fortnight's illness. The post-mortem showed tubercular nodules in the lungs, cherry nodules in the three cerebral ventricles on the vertex at the base of the brain, and most high; there was also very distinct fibrin there at the base, as if resulting from a past inflammation; the communicating space was so small that the third and fourth nerves had to be dissected up and cleared of fibrinous tissue, and the lobes along the Sylvian fissures were finely marked apices. The history of the case and the post-mortem appearance make it clear that a recovery had taken place from a fatal meningitis in a tubercular subject.

A permanent recovery from an attack of tubercular meningitis occurs in the vast majority of cases, a recovery from a general tuberculous—a result which is exceedingly improbable.

The prognosis becomes bad in the extreme, where the patient lies weak, in a comatose condition and Cheyne-Stokes respiration is present, though several days may elapse before the end comes.

The prognosis in simple meningitis is certainly more hopeful, especially in the subacute or more chronic cases. In those with an acute onset, high fever, and delirium, but little hope can be entertained, while the subacute may recover with chronic hydrocephalus and rigidity of the lower limbs and defective intelligence. Nevertheless, cases which are looked upon as almost certainly fatal will occasionally recover.

Diagnosis.—In a disease which begins so insidiously and advances such varied forms the diagnosis is successively difficult. It must be in the experience of most to have made mistakes in diagnosis, in suspending the onset of tubercular meningitis where the patient is only suffering from some dyspepsia or intestinal catarrh, and, on the other hand, making light of the anxieties of the friends when subsequent events have justified their fears. As regards diagnosis in the early stages too much stress must not be laid on irritability, grinding the teeth at night, loss of appetite, wasting, and sleeplessness, as these may be symptoms of a perfectly recoverable disease. On the other hand, sickness, yellowness, frequent shivering, staggering gait, temporary squint, loss of power of the sphincters, even though they subsided after a while, would justify grave suspicions. They may indicate the presence of tubercle or some irritation of the brain, which may be quickly followed by definite symptoms of meningitis.

The principal errors which are likely to be made may be summed up as follows:

1. Mistaking the vomiting of meningitis for some form of gastro-intestinal disturbance.

This is a very common mistake in the early stages in cases of meningitis, which begins with much vomiting.

The vomiting of meningitis, like the vomiting of gastric catarrh, usually

follows the ingestion of food, but is more likely to follow any disturbance of the patient; it may occur when the stomach is empty and the tongue clean. It is not very amenable to treatment, and is indifferent as to the character of the food taken. The vomiting of a gastric disturbance mostly ceases after the stomach and bowels have been unloaded. In any case of cerebral vomiting in a child a careful look-out must be kept for more definite brain symptoms, such as convulsions, dilated sluggish pupils, retracted head, and retracted abdomen. A heaving or intermittent pulse would strongly suggest the onset of meningitis. The past history of the patient is often important. The vomiting and convulsions persist at times during dentition, may be a source of difficulty.

2. The mistake may be made of attributing to meningitis cerebral symptoms due to the presence of some febrile disorder or reflex irritation. A child cutting his teeth may be irritable, heavy, drowsy, may start in his sleep and be feverish, simply from the effect of dentition or from undigested or improper food in his alimentary canal. The presence of fever of short standing is against meningitis, as also is evidence of dyspepsia, such as flatulence and colic; the condition of the gums should be carefully examined. A few days would decide the diagnosis. The diagnosis between typhoid and meningitis is not usually difficult, that between typhoid and acute tubercular tuberculosis being often much more so. The symptoms presented by a child suffering for typhoid may not be unlike those presented in the early stage of meningitis; vomiting, however, is not a symptom of typhoid; the fever persists and the condition of the abdomen would usually decide the diagnosis. The possibility of a simple meningitis occurring in the course of typhoid or pneumonia must be borne in mind, though it is not a common complication in either case.

3. At the end of certain exhausting diseases, such as acute diarrhoea, malaria, &c. in infants, cerebral symptoms due to cerebral anemia of the vessels of the brain are apt to arise, such as convulsions, coma, contracted pupils, convergent squint, &c. This condition has been called 'false hydrocephalus.' The history of the case, the depressed features, the almost powerless condition of the infant, and the rapid onset and course of the 'false hydrocephalus,' would usually distinguish it from meningitis.

The differential diagnosis between tubercular and non-tubercular meningitis is often impossible. A family history of tubercle or a history of the individual having suffered from cavernous glands or other tubercular manifestations, or having recently suffered from whooping cough or measles, would naturally favour a diagnosis of the tubercular variety, as would also an insidious onset. On the other hand, the history of a blow, or an otitis, or exposure to a hot sun, and a stormy onset, would favour the diagnosis of the non-tubercular form.

The diagnosis between acute meningitis and otitis is often difficult, and yet it is of the greatest importance. The relation between the two conditions is somewhat complex: a meningitis may undoubtedly arise from contiguity of disease bone in the ear or acute suppurative otitis; a purulent meningitis may exist with suppuration in both tympanic cavities or the latter cavity may contain cloudy fluid only, under circumstances which make it probable that the meningitis and otitis are both dependent on the same cause, and are

are related as cause and effect. There is much reason to believe that an acute suppuration in the middle ear may closely simulate acute meningitis, and there is little doubt that they have often been mistaken one for the other. Cases which have been diagnosed as acute meningitis have quickly recovered after a discharge of pus from the ear, either bursting through the tympanic membrane spontaneously or being relieved by incision. In cases of double suppurative otitis there may be intense pain in the head, fever, delirium, convulsions, optic neuritis, and deafness. The point of greatest diagnostic importance is the deafness without facial paralysis; for, as Gowers points out, meningitis 'never gravely injures the auditory nerve without the adjacent facial nerves'; nevertheless the diagnosis between otitis and otitis with superadded meningitis is exceedingly difficult and often impossible.

Morbid Anatomy.—The bodies of those who have died of tubercular meningitis are usually wasted in a high degree, but in some acute cases they may be fairly nourished. On removing the skull-cap and exposing the convex surface of the brain the veins on the surface will be found to be unusually full of blood; the convolutions are flattened, having been compressed by the distended lateral ventricles, and their surfaces are dry and sticky. More or less purulent-looking lymph is present: it may be usually seen on the lateral, less often on the convex surface. On examining the base, the effusion of lymph will be found to have taken place much more freely than on the convex or lateral surfaces. The Sylvian fissures will be seen to be lined with lymph; the interpeduncular space, with the optic commissures and tracts, the third, fourth, and eighth nerves, and the inferior surface of the pons, and cerebellum, will be found in the same condition. Lymph may generally also be found around the medulla and spinal cord. An examination of the small arterial branches will show that they are studded with minute grey or yellowish tubercles: the lumen of some may be occluded with thrombi.

In some cases hardly any lymph will be found, but instead the arachnoid is opaque and there is more or less effusion of cloudy fluid beneath it, while the brain substance is oedematous and watery.

Important changes are also present in the lateral ventricles. The vessels in the ventricles and great fissure forming the choroid plexuses and within interpositum are studded with tubercles and beset with lymph; the lateral ventricles are distended with fluid, while in the majority of cases the pons around, the corpus callosum, fornix, and optic thalami, have undergone white softening, and may be washed away or ragged out by a stream of water. The presence of fluid in excess in the lateral ventricles is due to the inflammatory processes going on in the choroid plexuses; this gives rise when in excess to dilatation of the ventricles, softening of the surrounding parts, and flattening of the convolutions. It was these mechanical effects which so struck the older observers like Wylie, who overlooked the presence of tubercles as the primary cause, and saw only in such cases an 'acute hydrocephalus' or 'water on the brain'. What further justifies these older observations is that in some cases the amount of lymph is very small and tubercles are found with difficulty, while there is much subarachnoid fluid as well as distention of the ventricles, and the brain substance is soft and oedematous. In a few cases large tracts of the superficial or central

parts of the brain are softened and diffused, the brain substance being yellow or plum-colored from the presence of extravasated and altered blood, effusions due to thrombosis or some disturbed condition of the circulation. A microscopical examination of hardened portions of the grey matter will show tubercles and effusion of leucocytes around the capillary arteries which cross the surface of the brain.

How do the symptoms during life correspond with the appearances found after death? The older writers were probably correct in ascribing the excitement during the first stage to the inflammatory engorgement of the arterial system of the brain; the later stages of drowsiness and coma to the effusion of fluid into the lateral ventricles, which gradually compressed the surrounding parts and interfered with their blood supply; the hemiplegia, paralysis of facial, &c., to the softening which so frequently takes place. The retraction of the head and stiffening of the limbs are also due, we are inclined to think, to the pressure exerted on the motor tract by the ventricular effusion.

Other tubercular lesions are constantly found in association with tubercular meningitis, the commonest of these being caseous mediastinal glands. The lungs also are rarely free from tubercle.

In non-tubercular meningitis the distribution of the lymph, which is often purulent, is less exclusively basal, more often being found over the convex surface and between the hemispheres in the longitudinal fissure. In the more chronic cases the base of the brain and cerebellum may be adherent to the skull, and much fluid may be present in the lateral ventricles.

Treatment.—The prophylactic treatment of tubercular meningitis is much the same as that of tuberculosis generally. All children who are so inclined require the most constant care in all the relations of life. Residence in cities must be prohibited, and country or seaside life insisted upon. A farmhouse where pure milk and cream &c. may be had, in a tracing but not too bleak situation, may be selected as a residence. All book work should be stopped, and all forms of excitement be strictly prohibited. The diet should be carefully regulated; fats, if they are found to agree, should be taken in large quantities.

The child should be warmly clad and carefully protected from changes of weather. The bowels, if they are inclined to be constipated, should be carefully regulated with *hyd. c. com.* or *chloath* and soda. The slightest suspicion of cerebral symptoms should be met by putting the child to bed in a darkened room, giving it a calomel purge, and an exclusively milk diet, and by the free administration of bromides. One or two grains of calomel with some sugar may be given, and some saline, such as a quart or half a sedlitz-powder, the following morning. Five to ten grains of bromide of potassium should be given every four hours. The vomiting is best treated by purging steadily, and giving peptonized milk prepared with Bengel's peptonizing powders, or Savory and Moore's sterilized peptonized milk. If persistent vomiting follows the giving of food, all food must be stopped by the mouth, and Brand's extract, or peptonized milk and bromide, must be given by means of an enema. Nothing is gained by continuing to purge after the initial dose of calomel has emptied the bowels thoroughly. If there is much cerebral excitement, larger doses of bromide may be given.

with the tincture or strong hyocyanin. We doubt very much if leeches, cups, or bleedings are of any service in tubercular meningitis, though in simple meningitis, if the excitement or delirium is severe, a leech applied to the temples will certainly relieve. Cold to the head is of undoubted value and in all cases should be applied, an ice-bag of india-rubber being used in preference to any other form. Lister's tubes form a convenient method of applying cold to the head, and they can be used where ice cannot be obtained. Mercury given freely in the form of perchloride is of all drugs the one most likely to be of service in simple meningitis. Iodide of potassium is frequently prescribed, though with doubtful advantage. Drainage of the subarachnoid space in cases of acute tubercular meningitis has been carried out by an opening made either in the lumbar or cervical spine, or peculiarly by trephining the occipital bone. Successful cases have been recorded, but we have no personal experience of the method. Operation if done at all should be performed before ossa vera is.

Chronic Meningitis.—A chronic inflammatory process, affecting more especially the convex surface of the brain, occurs occasionally during infancy, apparently also during intra-uterine life. In such cases the surface of the brain becomes adherent to the dura mater, a thickening of the membranes taking place, resembling the pachymeningitis of adults. A membranous exudation may be thrown out, and blood may be effused. Carlin has recorded¹ a case of this sort in an understood syphilitic child of seventeen months. It had suffered from repeated convulsions and was idiotic. At the *post-mortem*, there was no hydrocephalus, the dura mater was lined by a membrane of a gelatinous appearance, the same gelatinous material covered the cortex and base. The brain weighed 18 oz., there were some areas of sclerotic hardening on the fissure of Sylvius. Such a condition may be associated with a chronic hydrocephalus. The symptoms present in such cases are frequently not distinctive, or they may be simply those of chronic hydrocephalus; there may be defective intelligence or idocy, probably also emaciation; retraction of the head and rigidity and flexion of the limbs are likely to be present if the child lives any length of time. The etiology of such cases is doubtful; they are always suggestive of hereditary syphilis. As chronic hydrocephalus is often associated with the meningitis, a diagnosis of hydrocephalus is probably all that can be made during life.

A meningitis during intra-uterine life, by interfering with the growth and development of the brain, may produce various results, such as hydrocephalus, mal-development, or an abnormally small brain. Thus in a case² of Dr. T. Ballow's, in an infant dying at seven weeks of age, the head measured only 10½ inches round, and the brain weighed only 9 drachms; the convolutions were hardly recognisable over the greater part of the convexity, and the pia mater and cortex beneath it were invaded with calcareous plates; the choroid plexuses of the lateral ventricles were also partially calcified. In this case there seems to have been an intra-uterine meningitis, followed by calcification of the effused lymph and some atrophy of the subjacent brain tissue. In a case recorded by Dr. E. Holt³ is a child of thirteen months the symptoms were those of a chronic hydrocephalus, from which the child

¹ *Lancet*, January 1862, p. 154.

² *Path. Trans.*, vol. XXVIII, p. 41.

³ *Arch. of Pediatrics*, Dec. 1887.

had suffered since three months old. The enlargement of the head was only moderate: there was some rigidity of the posterior cervical muscles, but no paresis or contractures in the limbs. At the *post-mortem* the dura mater was found firmly adherent to the convexity of the brain; lymph and blood had been poured out on the surface. All the cavities of the brain were distant. See also Sclerosis of Brain.

Hydrocephalus

Acute Hydrocephalus occurs only in association with an acute meningitis. In the majority of cases of acute meningitis, whether tubercular or simple, there is an excess of fluid in the lateral ventricles, the mark of an intra-ventricular meningitis, and a consequent excessive radiation from the vessels of the choroid plexus. In exceptional cases the meningitis is confined to the ventricles. In those rare cases where an acute or subacute meningitis ends in recovery a chronic hydrocephalus may be left; it denotes the head slowly enlarges in succession to the symptoms of a meningitis. Excess of fluid may be found in the subarachnoid space in acute meningitis.

Chronic Hydrocephalus.—The accumulation of an excess of fluid in the ventricles of the brain is by no means an uncommon condition in infants and children. (1) It may be congenital, the accumulation taking place before birth, and it may give rise to difficulty in the extraction of the head. (2) It may follow an acute meningitis or subacute meningitis. (3) It may arise without any apparent cause. (4) It may be the result of a tumour, or be induced by a tumour of the cerebellum, compressing the veins of Galen, and in other ways interfering with the circulation.

In the majority of cases the child is born healthy, and the enlargement of the head is first noticed when the infant is a few weeks to a few months old; usually no cause can be assigned, but some of the cases are syphilitic, and it is not impossible that syphilis plays an important part in the production of hydrocephalus by means of a subacute basal meningitis. Enlargement of the head is preceded in a few cases by distinct cerebral symptoms, as convulsions, fever, and drowsiness, so as to suggest the probability of the meningitis perhaps being local rather than general. As the fluid accumulates in the ventricles the brain enlarges, the bones forming the vault of the cranium become thinned and open out, so that the fontanelles are enlarged and the edges of the bones at the sutures are separated from one another (see fig. 88). The fontanelles are bulged out, have a fluctuating feel, the occipital and parietal bones may be so thin that moderate pressure with the finger is sufficient to bulge them in. The cranium assumes a spherical form, and is increased in circumference with the child's face, which may be thin and sunken, giving the child a characteristic appearance. The forehead is rounded, and projects so as to overhang the face; the parietal and occipital bones assume a similar shape, so that the head has a globular or rounded form. There may be nystagmus. The general rounded contour is broken by the prominence of the frontal and parietal eminences; at these spots the bone is thick and solid, and consequently cannot be bulged out like the thinner bone elsewhere. The skin of the forehead and scalp is thin and shiny from being stretched, and the cutaneous veins are distended, especially when the infant cries; the eyes project; their axes may be divergent, and there may

be difficult in closing the eyelids. The infant cannot raise its head, and if propped up the head rolls over in a helpless sort of way. The condition of the intellect varies considerably. In the majority of cases, where the hydrocephalus is moderate in degree, the intellectual powers are surprisingly good when it is considered what amount of compression and flattening out the grey matter on the surface of the brain is exposed to by the accumulation of fluid in the lateral ventricles. In extreme cases there is certain to be marked intellectual defect, perhaps amounting to idocy. The limbs are mostly paralytic, and the lower extremities especially are rigid, and flexed upon the abdomen; permanent contractions are apt to follow, a result probably due

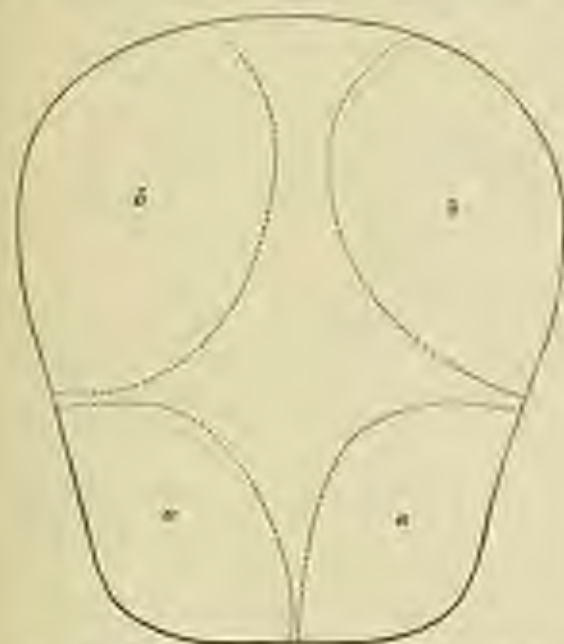


Fig. 38.—Diagram of Head in Chronic Hydrocephalus: *a*, *d*, frontal bones; *b*, *c*, parietal bones.

to compression of the pons. Atrophy of the optic nerves may take place from compression or stretching of the optic tracts or commotio. The course of the disease is usually chronic, and infants will live for months or even years, but ordinarily they gradually waste and die. The child shown in fig. 39, who was 6½ years of age, had suffered from chronic hydrocephalus since three months old; he was well nourished; his head measured 3½ inches in circumference; he was a complete idiot. The legs were bent at the knee and flexed on the abdomen, but the spasm of the muscles varied from time to time; the hands were kept closed, and the elbows were flexed and were or less rigid. We have known recovery to take place, even after rigidity of the legs has come on.

In older children, when the disease comes on after the closure of the fontanelles, the head enlarges more gradually, thinning the bones and even opening up the fontanelles and sutures: in these cases the hydrocephalus is mostly due to a cerebellar tumour; blindness and imbecility gradually supervene.

Diagnosis.—This is not difficult when the disease is well advanced; difficulty, however, occurs in the early stages when the accumulation of fluid is small, and when hydrocephalus may be mistaken for a rickety skull or simply a large head without distension of the lateral ventricles such as occurs in rickets. The friends of patients often ask whether a child who has a large head has "water on the brain." A diagnosis can only be made when the head enlarges under observation, the bones becoming thinned, the fontanelles bulged and fluctuating; the globular shape which it assumes distinguishes it from the misshapen head of a typical case of rickets with the prominent eyebrows, flattened vertex, and thick edges of the bones. In the simply enlarged head, from the presence of an abnormally enlarged brain, there is no opening out and bulging at the fontanelles, nor usually any evidence of a thin skull.



Fig. 100.—Chronic Hydrocephalus in a boy aged 1½ years.

Morbid Anatomy.—In those cases in which the excessive quantity of fluid in the ventricles is caused by a cerebellar tumour the mechanism is tolerably clear. In any stretching of the vermis cerebelli must compress the arched veins which run along at the base of the half circle, and consequently check the onward flow of blood in the veins of Galen and inferior longitudinal sinus. As the veins of Galen return the blood of the choroid plexus, it is easy to understand how a chronic hydro-

cephalus may be thus produced. In these cases the lateral ventricles are distended with a clear fluid of low specific gravity, the third and fourth ventricles just in the distension, and the cere is also enlarged. In those cases which form the majority, where no tumour is present, and no evidence of a past or present meningitis, the mechanism of the hydrocephalus is by no means clear. In these cases the lateral ventricles and their horns may be enormously dilated, the grey matter on the surface is flattened out and reduced in some cases to the thickness of cardboard, the convolutions being lost or only traced with difficulty. The contained fluid is clear, of specific gravity about 1005, with a small quantity of albumen and salts; the third and fourth ventricles are dilated; the pons is often flattened by the pressure of fluid in the fourth ventricle. The cause of this pooling up of fluid in the ventricles is by no means certain; it has been attributed to the closure of the aperture by which the ventricles

communicate with the subarachnoid space, which is situated near the inferior boundary of the fourth ventricle (Hilton). A local meningitis at this spot would readily seal up the opening. We doubt if this explanation suffices for those extreme cases of hydrocephalus so often met with: the more obstruction to the escape of fluid will hardly account for the accumulation of large quantities of fluid which must be absorbed under great tension. It seems more likely that there should be some obstruction to the escape of blood from the choroid plexuses, or some lesion of the latter which gives rise to an excess of cerebro-spinal fluid being secreted. It must be remembered, however, that the fluid drawn off from cases of hydrocephalus is of much lower specific gravity than serum, or the fluid drawn from a chronic inflammatory effusion, as in chronic pleurisy.

Treatment.—The treatment of chronic hydrocephalus when once established is unfortunately unsatisfactory, and but little can be done to influence the progress of the disease. In any case in which there is reason to suspect syphilis some mercury should be given internally, and some ung. hydrarg. applied to the head, or strips of mercury plaster, to effect a moderate compression, while some of the drug will be absorbed. Some cases in infants appear to be benefited by this treatment; but, assuming there is a chronic syphilitic meningitis, it is by no means certain to be influenced by anti-syphilitic treatment. Both mercury and iodides should certainly be tried, especially as there is no other drug which affords any chance of success. Some measure of success has been claimed for compression of the head by means of strips of plaster or an elastic bandage; if it is decided to try this method its risks must be borne in mind. The circulation through the scalp is interfered with by its compression between the skull and bandage, the brain is also compressed between the skull and the fluid in the ventricles. We have seen extensive sloughing of the scalp in a case of hydrocephalus, the result of a too tightly applied elastic bandage. No real compression can be of any service, and is decidedly risky; but a lightly applied bandage may be of use as a support. Puncture with one of Southery's canulae through the anterior fontanelle, avoiding the superior longitudinal sinus, offers more chance of at least temporary relief. It is usually harmless, though if too much be withdrawn there is a risk of collapse of the brain substance, with perhaps convulsions and sudden death. We have drawn off 12 oz. through one of Southery's canulae, but the fluid reaccumulated in a few days.

Of other methods of treatment we have had no experience. Pott has treated chronic hydrocephalus by incision and drainage, and Kunkle by puncture and injection of tincture of iodine to gums diluted with 20 grms. of water. It cannot be said with much success.

Hypertrophy of the Brain.—Ricketty children often have abnormally large heads, a condition which is frequently ascribed to 'water on the brain.' In reality such abnormally large heads are not hydrocephalic, their increased size being due in some cases to the prominent frontal and parietal eminences, but more often to an enlarged brain. The cause of this hypertrophy is not known, and the nature of the enlargement in the brain, liver, or spleen, which is apt to take place in rickets, is not clearly understood. In several cases coming under notice of children in their second and third years, with large heads, who have had rickets in a severe form and who

have died in convulsions, the brains have been large, the convulsions well marked, the brain substance fairly firm, and the microscopical examinations revealed no change that we could detect. Such brains are usually very vascular, but, as death often takes place through convulsions, it is hardly safe to assert that the vascularity is anything more than a secondary effect, resulting from the nature of death. In some cases the increase in size has been attributed to an increase of the connecting element, the neuroglia, but it is needless to say it is a very difficult matter to decide if this is so in a brain in which the enlargement is general; in our own cases, certainly, there was no striking change. It is certain that enlargement of the brain in these cases is not accompanied by any precocity of intellect; indeed, it is rather the reverse, as such children are mostly backward, not only in physical but also in mental development. If the quantity of brain matter is large, the quality is certainly poor.

Atrophy of the Brain; Sclerosis of the Brain.—This condition is more often local than general, and is mostly secondary to some inflammatory lesion or softening which has preceded it either during *intra-uterine* life or after birth. Among the local regions which suffer are the cerebellum or cerebellum, or one half of either; a portion of a hemisphere may be atrophied, so that there is a marked depression where the convolutions



FIG. 50.—Sclerosis of Brain. From a boy of twenty months. The convolutions have disappeared, the surface of the brain resembling a half-bald lion suddenly depilated. The openings which transmitted the meningeo-vascular vessels appear as black points.

are absent, which has been called *Parencephalus*; or almost any part of the brain may be affected. In rare cases the whole or greater part of the brain is shrunken and indurated, as the result of a meningo-encephalitis occurring during *intra-uterine* life, or shortly after birth; such cases are probably syphilitic. As an instance of an atrophied or sclerosed brain the following may be mentioned.

Atrophic Brain.—A child who died at the age of twenty months had been a complete idiot from his birth and had suffered from convulsions; he was blind and deaf; his legs and arms were drawn up and stiff. At the *post-mortem* the brain was found small and shrunken over the convex surface; the convulsions had completely disappeared, the sur-

case being amply covered by the smooth and granular substance (outlined in blue), in the base and median sulci the convolutions were fairly well mounted. The pia mater consisted of many tortuous vessels, which could be dissected off. On vertical section it was seen that the grey matter and white matter also were fixed and shrunken, and hardly distinguishable from one another. Microscopical examination showed an increase of connective tissue and an absence of nerve elements. There was disorganizing degeneration in the pons and medulla (see fig. 20).

The brain may be of abnormally small size, and yet the brain substance normal; in such cases there is usually more or less mental defect.

In some cases of children who have suffered from chronic wasting secondary to gastro-intestinal atrophy, during the last few weeks of life the lower limbs become more or less fixed and rigid and the abdomen somewhat retracted. At the *post-mortem* the cerebral hemispheres are partially shrunken and an excessive quantity of fluid is present in the subdural and subarachnoid spaces. Presumably this atrophy is secondary to malnutrition, the result of failure of the digestive powers.



Fig. 21.—Showing Atrophy of left side of the Cerebrum. The right side of the cerebrum is slightly smaller than the left.

In the following curious case, atrophy or shrinking of one half of the brain appeared to follow a fall on the head:

Atrophy of a Cerebral Hemisphere.—Edward H., seven months, admitted to the Children's Hospital, April 1893. The mother states the boy was perfectly healthy, and had the use of his limbs up to fourteen weeks ago, when he accidentally fell off a table, striking the left side of his forehead on the floor. He was picked up unconscious, and remained

as for three hours; on consciousness returning he was convulsed. The next day he was again convulsed and again became unconscious, in which condition he remained for three weeks. At the end of this time he regained consciousness, and it was found that his right side was paralyzed. On admission he was a well-nourished child, his skull was well shaped and symmetrical, his right arm and leg were at a condition of speech paralysis; pointing his attempts to avoid them; there was no squint, but slight squableness. He was very fractious and not intelligent. As it was supposed, there was a clot of blood compressing the left hemisphere; it was decided to explore. On trephining the bone was purple in colour and partially elevated on dividing it; much clear fluid escaped; there was evidently an enlarged subdural space. The child sunk twenty-four hours after the operation. At the *autopsy* it was found both sides of the skull were symmetrical, the left hemisphere was much smaller than the right (see fig. 90 and 91), the right side of the cerebellum slightly smaller than the left. There were no traces of a past meningitis or haemorrhage, nor any thrombosis or embolism. The convulsions in the left hemisphere were situated, but not actually so; the pia mater pointed off mostly; central neurons after fracturing a Mober's fluid, showed there had been a general shrinking of the left hemisphere, or, at any rate, of parts were proportionately smaller than the right. There was also hypertrophy of the right side.



FIG. 90.—Transverse Section of Brain shows in fig. 91. The space between the left side of the cerebrum and the dura mater, shown by dotted line, contained fluid.

Histological examination showed there had been a chronic inflammatory degeneration of the left hemisphere. It was suggested that the case was really congenital, the brain being compressed against this view, however, is the fact that the skull was symmetrical and was no smaller on the left side than the right; and the mother was very positive with regard to her being quite well up to the time of the accident. He had not suffered from convulsions prior to the fall.

Tumours of the Brain

While cerebral tumours are by no means uncommon during childhood, the different varieties found are few. In the vast majority of cases the tumours or tumours consist of cystic masses formed by a local tubercular process. These tubercular masses especially have a marked predilection for the cerebellum, but are found also comparatively frequently in the pons, basal ganglia, and cerebral hemispheres, both on the surface and in the connecting white substance. Cysts of uncertain origin are also found, especially in the cerebellum. The pons seems the favourite seat of gliomas when they occur. Other new growths, such as epithelial carcinomata, may be occasionally found growing from the choroid plexus or pia mater. Perivascular sarcomata growing from the blood are not uncommon, compressing the grey matter. No age is exempt; tubercular tumours have been found in infants a few months old, though they are more common somewhat later. Densey found a cheesy mass in the cerebellum of a newly born child, so that tumours may form during intra-uterine life. Little is known as to the cause which determines the growth in the brain or its coverings; it appears certain, how-

ever, that an injury acts as an exciting cause. A fall or blow on the head is followed in the course of a few weeks or months by cerebral symptoms. On the fatal termination a cheesy tumour is found in the cerebellum. How the injury can have given rise to this can only be surmised; possibly there is a local bruising and puriform hæmorrhage. The most common tumour to follow a blow is a tubercular tumour, but then tubercular tumours are vastly more common than any others; nevertheless a cyst or a syphiloma or a pineal tumour does appear to follow a blow at times.

Symptoms.—The general symptoms include: (1) persistent headache; (2) paroxysmal vomiting; (3) optic neuritis; (4) convulsions. The local symptoms are those caused by the tumour interfering with the function of some region, and causing some local paralysis or spasm, or incoordination of movements, or pressure on some sensory channel and consequent disturbance of the circulation.

Headache is almost constantly present, though in young children, who are unable to complain or describe their feelings, its presence or absence cannot be determined. Its locality may help to indicate the seat of the lesion, but for this purpose it is an uncertain guide; it may be either frontal or occipital in tumours of the cerebellum, and it may shift about from time to time, but if fixed and constant at one spot it is of some value for localisation. It is usually tolerably constant, or not absent for long together, but is apt to be much worse at some times than others. It is mostly made worse by movement, and when the child is up and about, and is better when it is at rest and lying down. Percussion over the seat of the headache usually makes it worse or gives acute pain, but it is seldom of any diagnostic value in children. The headaches most likely to be mistaken for those due to a tumour are the hysterical headaches, which are often very persistent and severe.

Vomiting is a frequent and very characteristic symptom, and may be present in tumours of all parts of the brain, especially of the cerebellum, pons, and medulla, and when the root of the pneumo-gastric is involved. The vomiting usually comes on suddenly without warning, and without much nausea, and may be repeated daily or several times a week without any cause being detected; such vomiting is very suggestive of cerebral disease, though it must not be forgotten that hysterical vomiting also occurs, especially in girls about puberty. There may be nausea and constant sickness, with much retching, in the later stages of a cerebral tumour. It is often paroxysmal, coming on and lasting for several days continuously, being not amenable to treatment, and then suddenly improving.

Optic neuritis occurs in the majority of cases sooner or later, and is especially common in tumours of the cerebellum, less so in those of the frontal regions. The discs become swollen, so that on examination the edges appear at first blurred, and then all distinction between the edges of the disc and retina is lost, even to the direct method of examination. The veins become distended and tortuous, and hæmorrhages occur; finally, after some months, the discs gradually pass into a condition of atrophy. The exact cause of optic neuritis is uncertain; it occurs in association with tumours in all parts of the brain, but may be absent from first to last; it has been known to occur in strabismus in distance of the cord without any discoverable cerebral lesion. In a case of our own, of acute strabismus, there was optic neuritis, and no lesion of

the brain was discovered post mortem. The neuritis appears to be in some cases a descending one, passing along the sheath of the optic train and producing an extensive inflammation at the papilla: but this can hardly be the case often. It is much more likely to be a reflex inflammation, such as herpes facialis, which so often appears on the lips and face in inflammatory conditions of the respiratory tract. Optic neuritis, it is important to remember, may occur without any loss of sight, though as atrophy sets in the sight is certain to be damaged. It is often of great diagnostic importance, its presence being of much value as an indication of a cerebral lesion, though its absence in any given case where other symptoms point to some cerebral lesion does not necessarily negative the diagnosis. Optic neuritis may come on either early or late in the disease.

Giddiness is often complained of, most commonly in disease of the cerebellum and pons.

Convulsions.—The first symptom may be a convulsion, which may never be repeated, or convulsions may be frequent during the course of the disease, and may occur in the case of tumours of any part, but more especially when the growth involves or compresses the motor cortical centres than when the cerebellum is involved. Such convulsions may be epileptiform, but without aura. In these cases the nature of the aura and the commencement of the fits in some special part afford an indication of the seat of the tumour which is situated in the cortex. The convulsions, which commence in one part, may quickly become general.

Paralysis.—The various paralyses and other local symptoms will be referred to later on under the regional symptoms.

Tumours of the Cerebellum.—One of the common seats for a cherry cyst is in the lateral lobes of the cerebellum. It is not uncommon to find these cysts varying in size from a pea upwards in the lateral lobes of a child who has died of tubercular meningitis, without any definite signs of their presence having been given during life. In cases of cerebellar tumour which have proved fatal, a cherry cyst may be found which has, perhaps, become adherent to the posterior fœssa of the skull and tentorium, and has very likely extended across the middle line, encroaching on the medulla, and encroached the motor tracts passing downwards to the cord. Another pressure effect is the compression of the straight sinus by the stretching of the tentorium, and a consequent pouring up of the blood in the vein of Galen, and chronic effusion of fluid in the lateral ventricle. A large cerebellar tumour is almost certain to be accompanied by chronic hydrocephalus, the lateral ventricles are greatly dilated, the skull thinned, and perhaps the pons may be more or less compressed and flattened by the pressure of the fluid. A tumour of the middle lobe is more likely to compress the motor tracts in the floor of the fourth ventricle than one in the lateral lobes. A simple cyst in the cerebellum is not uncommon.

Symptoms.—The history obtained from the friends usually includes headache, more or less vomiting, and apæria. In young children it may be that enlargement of the head and more or less blindness are early noticed.

An examination of the patient elicits the fact that the headache is either frontal or occipital, and of varying intensity; in one of our cases the pain was

always referred to the right occipital region, and the boy would sometimes be found asleep with his head placed on this spot. At the *post-mortem* examination a large sarcomatous tumour was found in the right lobe of the cerebellum. It is, however, not unusual for the patient to be able to localize the lesion in this way. The headache is usually described as an 'ache' rather than as a sharp pain, but in some cases we have known it to be intense, suggesting the presence of meningitis. The vomiting, like cerebral vomiting generally, is fitful and uncertain; as a rule it is not persistent, and it comes and goes in an erratic manner. It is rarely troublesome when the patient is at rest in bed. Internal squint is in our experience an early and frequent symptom; it is not always double, and sometimes one eye is affected more than the other; the strabismus is due to a paresis of the sixth nerve, and not to a spastic condition of the internal recti. In one case coming under our notice a boy who suffered from headache, and who had developed an internal squint, was operated on for the strabismus by a surgeon; the latter, however, altered his opinion with regard to the case when he discovered optic neuritis to be present. The boy had a cerebellar tumour. Optic neuritis is a common and early symptom; greater or less limitation of the field of vision and blindness usually follow.

In all cases there is sooner or later a peculiar gait or walk, due to more or less weakness in the legs. This peculiar gait is often described as 'ataxic,' and 'cerebellar ataxia' is sometimes said to be present; or there is a staggering gait, or a difficulty in maintaining the equilibrium. Sometimes attention is called to a patient's supposed tendency to fall forward or backward, or to one side. Now it is certainly true that the patient's friends often give a history of staggering or easily falling, and if a child with a cerebellar tumour is got out of bed and made to promenade up and down the ward, he will most likely sway and easily fall, or he may strain forward, as if wound up, in a clumsy headlong way. But we confess we are sceptical with regard to the existence of a special 'cerebellar ataxia,' and we cannot call to mind any case in which we could satisfy ourselves that it existed. The gait of a child with a cerebellar tumour is very much that of a child learning to walk; there is a good deal of clumsiness and a great readiness to fall, but this is due to a weakness or paresis of the limbs, and not to ataxia. When there is a spastic rigidity, with an over-action of the gastrocnemius group and of the flexors of the knee, there is necessarily a clumsy gait with a tendency to fall forward. We have never been able to satisfy ourselves that in any given case, apart from the results of a spastic rigidity, there was a tendency to fall on one side or in any given direction.

An increased tendon-reflex is indeed the rule, but occasionally it is entirely absent or diminished. We cannot give a reason for this, and we doubt the correctness of the one that has been given, namely, that it is due to a destructive lesion of the cerebellum.

Enlargement of the head is common; this takes place only in young children on account of the readiness with which the cranial bones yield to the internal pressure, but it may take place also in children of six or seven years of age.

Eclampsia is not uncommon; the general type is that which consists entirely of tonic spasms; there is retraction of the head, rigidity of the

limbs, and frequently convulsions. Death may take place in one of these attacks on account of the spasms of the respiratory muscles.

Facial paralysis, mostly single and slight, and also nystagmus, are among the occasional symptoms.

In the later stages, should the patient survive, the limbs pass into a condition of semi-rigidity; at first this is temporary, but later it becomes permanent. The arms as well as the legs are affected, while the head becomes more retracted and fixed. Marked wasting is certain to exist in the late stages, and various trophic changes, such as sloughing of the eye and bedsores, generally follow.

Are the above symptoms the result of a destruction of a portion of the cerebellum? In our case the answer must be in the negative; they are the symptoms produced by a gradually increasing dropy of the ventricles, due to the tumor of the cerebellum stretching the tentorium cerebelli, and obstructing the return of blood from the veins which drain the ventricles, and which empty themselves into the straight sinus. If the cerebellar tumor produces any symptoms *per se* as they are masked by those produced by the hydrocephalus. In connection with this we may bear in mind that cases have been reported in which there has been a congenital absence of one half of the cerebellum, and in which no symptoms have been observed during life. As a result of this obstruction of the vein Galeni, third is put up in the lateral ventricles and also in the third and fourth, and the surrounding parts are compressed. All the ventricles become dilated, the aqueduct of Sylvius becomes large enough to admit the finger, and the pons is flattened. The sixth nerves are compressed beneath the pons, giving rise to internal strabismus, and the facial may be compressed also. Pressure of the fluid on the motor tracts gives rise to the paralysis of the limbs and consequently to staggering gait, and at a later stage to spastic rigidity. The headache is presumably caused by the stretching of the tentorium. Whether the choked disc is the result of a reflex irritation, or of a disturbance of the circulation, is an open question. It is curious to note that in chronic hydrocephalus, where the large quantity of fluid is due to an excessive secretion without any obstruction of the veins, there is only exceptionally paralysis of the sixth nerves and rarely optic neuritis, though there may be blindness. These cases, however, are either congenital or commence in early infancy before the sutures have united, so that tension is relieved by the enlargement of the skull.

With regard to the differential diagnosis between hydrocephalus, the result of the growth of a cerebellar tumor, and hydrocephalus due to subacute meningitis, or to a chronic simple effusion, difficulties are certain to occur. In infants or young children suffering from enlargement of the head, vomiting, and rigidity of the muscles of the neck with retraction of the head, we may be in doubt whether the child suffers from a chronic basal meningitis or from a cerebellar tumor. In these cases the temperature might help, there being at all probably an evening rise of a few degrees in meningitis, while the presence of optic neuritis would favor the diagnosis of tumor. In simple effusion the case is usually very chronic, and optic neuritis rarely occurs.

Our experience of tumors of the middle lobe of the cerebellum is very

lesioned. We should be inclined to expect that the most prominent symptoms would be those caused by direct pressure on the floor of the fourth ventricle. This certainly was the case in a patient of our colleague, Dr. H. R. Hinton, the most marked symptoms being retraction of the head and neck, coming on in paroxysms and accompanied by severe pain, apparently due to the cramp of the muscles. At the *post-mortem* examination a cystic tumour of the inferior vermiciform process was found, which had pressed upon and fattened the floor of the fourth ventricle.

To sum up as regards diagnosis. The symptoms of a tumour of one of the lateral lobes of the cerebellum are those of a gradually increasing hydrocephalus, with the addition of optic neuritis and vomiting. It is only occasionally possible to say on which side the tumour is situated, and then only by means of the palsy, which may be referred to the actual spot. The so-called ataxic gait is due to paresis or semi-rigidity of the limbs. When the tumour occupies the middle lobe the most marked symptoms are retraction of the head and neck, arching of the back and exaggerated tendon reflex.

Tumours of the Pons and Medulla.—Tubercular masses not infrequently invade the pons, being situated in the central part, or small masses may be found in the floor of the fourth ventricle. They are apt to cause symptoms, less, perhaps, by their direct pressure effects, as they grow but slowly, than from the softening which often surrounds them; yet at the *post-mortem*, when the site of the fleshy mass is discovered, we have often been surprised how little paralysis was present during life. Gliomas of the pons are not rare in older children.

Symptoms.—The combination of symptoms in disease of the pons varies much in different cases; this is due to the close proximity of the motor tracts and the centres of various cranial nerves. The paralyses produced by disease of the pons are apt to be bilateral, on account of the right and left motor paths and nerve centres being near together. The symptoms vary according to the position of the lesion in the pons; thus in a case of our own, in which a glioma commenced in the right lower border, there was 'crossed paralysis,' i.e. a left hemiparesis with paralysis of the right cranial nerves, and right facial paralysis, optic neuritis, and vomiting. Fleecy masses are often more centrally situated, and may after a while involve the medulla; there may then be double facial paralysis, perhaps more marked on one side than the other; the saliva dribbles from the mouth, the speech is thick, and there may be difficulty in swallowing. There may be paresis and rigidity of the limbs, squint, and sloughing of the cornea from interference with the fifth.

Basal Ganglia and Internal Capsule.—Fleecy masses may be present in the caudate or lenticular nucleus or thalamus, but they only produce a definite hemiplegia when they involve the internal capsule. In one of our ten cases a villous growth from the choroid plexus compressed the left thalamus and internal capsule, and produced a palsy of the right arm and leg, with marked rhythmical shaking movements when voluntary action was attempted, so much so that his mother said his arm used to 'work like a clock;' contractures, facial paralysis, and optic neuritis supervened before death. The rhythmical tremors were no doubt produced by gradual pressure on the motor path which passes along the internal capsule. In children

there is rarely loss of sensation: this occurred, however, in one of our cases, in which two large cheesy masses involved the whole of the posterior limb of the internal capsule, the arm and leg of the opposite side being contracted and anæsthetic.

Tumours of the Cortical Layer.—Irritation of any part of the motor area of the cortex, which includes the ascending frontal and parietal convolutions and the anterior portion of the superior parietal lobe, gives rise to convulsions, which begin in the arm, leg, or face, according to the part affected. Destruction of this region, as by suffering following embolism, or the presence of a tumour, gives rise to a hemiplegia affecting the face, arm, and leg, a partial destruction giving rise to a partial paralysis. The presence of a syphiloma, a tubercular mass, or pressure by a tumour growing from the meninges, is likely to give rise to epileptiform seizures, the convulsions starting in the arm, leg, or face, though they are not necessarily confined to the limbs in which they start, but may become general. In the later stages a hemiplegia results.

Tumours of the Frontal Lobe produce no paralysis unless they encroach upon the ascending frontal convolution: in that case they may produce a paresis of the leg, arm, and face, according to the part involved. A tumour involving the posterior third of the left frontal convolution causes aphasia.

Prognosis.—The prognosis in cerebral tumours is exceedingly unfavourable, whatever their nature may be, unless perhaps syphilis may be excepted. Undoubtedly tubercular masses may cease to spread and become cystic, though against this must be set off the chance that other masses may form or the child die of tubercular meningitis or tubercle elsewhere. Every other form of tumour is certain to progress from bad to worse. In the majority of cases the progress is slow, often lasting over a year or more. Death may supervene from intercurrent disease, as tubercular meningitis, or other form of tubercle: it may be sudden in tumours of the pons and cerebellum, and may be exceedingly slow, as in cases of cerebellar tumour and chronic hydrocephalus. Occasionally cases in which the diagnosis of tumour is made partially recover, or remain stationary for many years. Gowers records a case of a girl of fifteen years who suffered from hemiplegia, headache, hemianopia, and optic neuritis of gradual onset; she gradually recovered, except the hemianopia and paresis of arm, and was well, with these exceptions, six years after. In a case of a girl aged ten years, whom we saw by the late Dr. Ross and one of ourselves, there could be little doubt that there was a cerebellar tumour, as there was optic neuritis and spastic condition of both legs: she eventually recovered while under the care of a quack, but became quite blind.

It is not uncommon to find cystic degeneration in the brain, evidently the result of the shrivelling up of a tubercular mass. This was so in the following case:

Grey Tumour of Cerebellum. Temporary Recovery.—A boy aged 11 years was admitted into hospital, November 1876, with internal squint, optic neuritis, and almost complete blindness. He was intelligent and walked alone: there were no signs of any paralysis, he had no headache or vomiting; during his stay he got better, and was discharged (January 1877) apparently in good health, though quite blind from optic atrophy. He was readmitted, February 1877, having suffered for six months with pain in his back.

and scarcely he had lost power in the right side; the right elbow was semi-flexed, the arm protruded and flexed, the fingers were extended, except at the metacarpal joints; the toes were bent, and the ankle in the position of equinovarus; there was also loss of sensation on the right side, and the boy had some difficulty in finding the right arm with his left. In March there was some difficulty in swallowing, with purpus of left side of face and arm, followed by death. At the *post-mortem* there was a small cyst with thickened meningeal wall on the inferior surface of the right frontal lobe, evidently the remains of a tubercular mass; there was a shaggy mass involving the left caudate nucleus and optic thalamus and internal capsule; there was a second shaggy mass involving the lentiform nucleus and internal capsule of the right side. In this case there is no doubt there was a shaggy mass in the right pre-frontal lobe on the inferior surface, which grew on to the symphysis and internal apophysis, and which passed into a quiescent stage; subsequently other tubercular masses formed, which, with a general tuberculous, caused his death.

Diagnosis.—The most important point to be decided is whether there is a cerebral lesion, or the symptoms are due to functional disease; the question as to the nature and seat of the lesion is of less practical importance. The cases which at first sight present a superficial resemblance to cases of cerebral tumour are those of chronic headaches in children at puberty, which are often severe, and are sometimes accompanied by vomiting or nausea. The latter, however, are never accompanied by optic neuritis or by sudden vomiting, are rarely acutely painful, and are unproved, or got rid of for a time, by active exercise in the open air. The headaches of a cerebral tumour are severe, sometimes make the patient scream with pain, and are made worse by active exercise.

The vomiting in a case of cerebral tumour is senseless, coming on the first thing in the morning, is perhaps constant for a day or two or more, then passes away for a while without any apparent reason. The paralytic of hysteria are not often hemiplegic, being more often paraplegic, and are never accompanied by optic neuritis.

When fits are present there may be a difficulty in distinguishing between epilepsy and a tumour, especially as a hemiparesis is apt to remain after a fit. In these cases, if the convulsions have constantly a local commencement, they are probably due to a tumour, and later on optic neuritis or some paralysis would decide the diagnosis. The presence of more than one fit may make the differential diagnosis difficult.

Treatment.—Except in the case of syphilomas of the brain, the treatment of cerebral tumours by medicines resolves itself into a treatment of symptoms. Wherever there is the least chance of the tumour being syphilitic, iodide of potassium should be given in full doses; though in children syphilitic disease of the brain is rare. If it is supposed that the tumour is tubercular, cod liver oil and iodide of iron may be prescribed, while the child is kept at rest, and placed under the most careful hygiene.

For the headaches, bromides, Indian hemp, and opium may have to be prescribed. The vomiting, which is so often troublesome, must be treated by perfect rest in bed, peptonised milk or ice drinks being given in small quantities. Hydrocyanic acid may be given. The vomiting is exceedingly irritable, coming and going without any apparent cause. In some tumours at least the question of operation may be entertained (see *infra*).

Cerebral Abscess.—In children, as in adults, the common cause of abscess of the brain is injury or ear disease; less often it is the result of

suppuration in a distant part, as an empyema or abscess of lung. Abscess is most common in the cerebrum, less frequent in the cerebellum or pons.

Symptoms.—The early symptoms are those more or less of meningitis, namely headache, fever, vomiting, and perhaps convulsions; they may, however, be very slight and easily overlooked. The later symptoms, those of the chronic stage, vary according to the seat of the abscess, and are more or less those of a cerebral tumour, including optic neuritis, headache, vomiting, convulsions, and varying paralyses, also perhaps hebetude and emaciation. The diagnosis of abscess from meningitis or tumour is sometimes very difficult, as the following cases show. A girl of two years of age who was admitted into hospital under Dr. Burton, had had a discharge from her right ear for three months, but was otherwise well and strong, till fourteen days before admission, when she had a right-sided convulsion lasting four hours, followed by unconsciousness; four days afterwards she had a similar attack: she squinted, and was more or less blind after it. On admission there was almost complete motor and sensory paralysis of the right arm and leg, with loss of sensation on the left side of the face and pines on the left: she became convulsed, the convulsions beginning in the right side, and was unconscious before death. At the *post-mortem* an abscess cavity was found in the left temporo-sphenoidal lobe, extending into the occipital lobe and reaching the internal capsule. It contained three ounces of pus. The left hemisphere was full of pus. In the following case the abscess followed a perforating wound of the orbit. A boy aged six years was playing in a hayfield when by accident he was wounded above the left eye with the prong of a hayfork; the eye swelled, but no external wound was found. During the next few weeks he was irritable and frequently vomited. Six months after he was brought for advice, as his sight was failing. On admission he was quite blind (atrophy of discs) and somewhat dull of comprehension; he could walk well; the right hand was weak, but not paralysed; he continued much the same for a month, when he died suddenly. At the *post-mortem* the left frontal lobe was larger than that of the opposite side, its convolutions, including the superior, middle, and inferior, with more or less of the ascending frontal and parietal, flattened; its inferior surface was adherent to the orbital plate and of a yellow tinge; and there was an abscess containing four or five ounces of greenish pus. It was clear there had been a penetrating wound through the orbital plate into the brain.

Treatment.—Where pus has formed there is little hope is any method of treatment, except operation.

Surgical Treatment of Cerebral Lesions.—Our knowledge of the operative treatment of tumours of the brain is still very limited, but enough has been learnt to justify a short account of the subject being given here. At present only those growths which lie on or near the surface of the cerebrum will be successfully dealt with: tumours at the base of the brain, or involving the basal ganglia, may be looked upon as inaccessible to surgery at present, and though cerebellar growths are not beyond our reach, but little has yet been done for their removal. Surgery chiefly deals with growths situated in the motor area of the cortex, since the localisation of the tumour is more satisfactorily to be made out in this region. Again, only those growths which are of limited size are suitable for removal, since the destruction of

disturbance of large areas of the brain would lead to as great evils as the tumour itself. Assuming that the presence and exact position of a tumour have been ascertained by the symptoms presented, the following are the steps to be taken for its removal. If time permits, at least twenty-four hours should be devoted to preparation of the patient for the operation. The entire scalp should be shaved and thoroughly cleaned with turpentine; after this a compress soaked in solution of corrosive sublimate, 1 in 1000, or carbolic acid, 1 in 40, should be kept applied to the head for an hour before operation. The utmost precautions should be taken to have all instruments, and anything likely to come into contact with the field of operation, thoroughly aseptic. After the child has been anaesthetised, a large flap of integument, having its centre over the seat of the tumour, should be reflected and the bone laid bare. Next a large circle of bone should be removed with a trephine or gouge, or saw, and the dura mater exposed—the opening must then be enlarged by cutting forceps or saw as may be required. All bleeding must be arrested. The surface of the dura mater should then be carefully examined as to its colour, as to the presence of pulsation, and as to any tendency to protrusion through the aperture in the skull. We have noticed in a case of cerebral tumour thinning of the bone over the seat of the growth, with encroachment of the diploe vessels, but this can only be expected to be seen when the growth is large and superficial. Should the tumour be extra-dural, its removal may be now accomplished; but if it is truly cerebral, a crucial incision should be made in the membrane, and the surface of the brain inspected and felt with the finger for evidence, either visible or palpable, of its mass; if the growth is seen, its size and connections should be ascertained, and the question of the possibility of its removal decided upon. If it is determined to proceed with the operation, the substance of the cortex must be separated from the growth, and the mass removed with as little injury as possible, both to brain substance and to the vessels of the part. If there is oedematous (encephalitis) of the brain round the growth, the prognosis is bad, but any actually disintegrated brain should be removed. All bleeding is then to be arrested, the dura mater sutured over the brain, and the portion of skull removed, which should have been kept lying in warm carbolic lotion (1 in 50), may be cut up into pieces about the size of cherry seed, and replaced on the surface of the membrane; or the whole disc of bone may be replaced entire; even, however, if the bone is not replaced, the gap is largely filled up by bone. In some cases, of course, it is desirable to leave the aperture yielding, so that it may give way before increased intra-cranial pressure. Provision may be made for drainage, or the wound may be closed and dressed aseptically in the ordinary fashion. After the operation the child is kept absolutely quiet in bed, and fed on weak animal broths and diluted milk in small quantities. If the case is doing well, there will be no need to disturb the dressings for a week or ten days, when the wound will be found healed, with the exception of the dural opening. Should no growth be found, or should there be very extensive encephalitis, or if the tumour be too extensive for removal, the operation must be abandoned. Such are briefly the general rules to be adopted in dealing with brain tumours, and a large part of the description will also apply to operations for cerebral abscess, or for those cortical lesions which give rise to epilepsy or other troubles and necessitate

surgical measures. A few additional remarks may be made on the two last-mentioned subjects. As to cerebral abscess, it is the result, apart from tuberculous, most commonly of injury or disease of the ear; in the case of traumatic abscess the seat of the abscess will usually, though not always, correspond with the seat of the external injury, though this guide should be, of course, supplemented by the indications given by any paralysis that may be present. The steps of the operation are those already described; should, however, no evidence of the abscess be seen on exposing the brain, careful systematic exploration to a depth of from one to two inches should be made in every direction from the centre of the part exposed. This is best done with a grooved needle, fine trochar and cannula, or director. Should pus be found, the opening must be enlarged and the abscess cavity drained, and the operation completed as above described. (For further details of cerebral abscess, the reader is referred to the chapter on Diseases of the Ear.)

Where trephining is done for Jacksonian epilepsy, it must be remembered that pressure or irritation may be due to a depressed or thickened portion of bone, to a local pachymeningitis, or to a cicatrix, or to local inflammation of the cortex of the brain itself. If the irritant is cranial, the offending bone must be removed. So also, if a local thickening of the dura mater is found, it should be excised. If, however, the lesion is in the brain itself, the question arises whether it is so extensive that removal of the injured part can be effected without an extent of paralysis following which would render the patient's condition worse than it already is. The details of the operation are the same as in the case of tumour or abscess. For further information we must refer to the papers of Dr. Maccewen, Mr. Horsley, and others. There is no doubt that, on the one hand, the brains of children are more tolerant of operation than those of adults, and, on the other hand, that brain lesions which would prove fatal to adults are not only recovered from in children, but may leave little or no permanent effects, even if left to nature. Each case must be judged on its merits.

The danger of *hernia cerebri* and diffuse encephalitis or meningitis are no doubt considerable, but with thorough antisepticism these risks may be generally avoided. It has been shown by Dr. Maccewen that *hernia cerebri*, though it may result from imperfect wound management, may also be due to a pre-existing encephalitis, even in the absence of any septic condition of the wound. Should *hernia cerebri* appear, it is best dealt with by pressure applied over the wound by means of a plate of sheet-lead laid outside the inner layer of dressings.

The subject of operative measures in disease and injury to the *spinal cord* is still more in its infancy than is that of cerebral surgery, and no definite rules can be laid down; some account of the matter will be found under the head of *Spinal Caries and Spinal Lesions*.

It must be looked upon as possible as a *much more serious matter* is open the spinal than to incise the dura mater; hence greater hesitation should be felt in dealing with cases requiring so severe a measure.

Cerebral Hemorrhage.

We have already remarked (p. 16) that cerebral hemorrhage occurring in early life is hardly ever the result of a ruptured artery. Hemorrhage

does, however, not infrequently take place from the venous capillaries on the surface of the brain, and also, though in less degree, into the grey and white matter. The pia mater and its capillaries are exceedingly delicate in the infant, and when distended with hypervenuous blood, as during some intermitten to the respiration, they are exceedingly liable to rupture or to allow the blood to ooze through their walls. Hypervenuous blood appears more readily to escape from the vessels by oozing than does ordinary blood. Meningeal bleedings of a larger or smaller amount are constantly found in infants who have been born asphyxiated, or who only survive their birth a few days in consequence of feeble respiratory powers (see fig. 4). The same condition is seen in infants who have been 'overlain in bed,' and in those who have died in convulsions. Clots of various sizes may also be found in the central white matter, in the internal capsule, and in the masses of grey matter at the base of the brain. The younger the infant the greater will be the brain damage done by the bleeding, as the brain is exceedingly soft at birth and easily injured; the more immature the brain, the more is its development likely to be interfered with. As the result of the brain damage there may be hemiplegia, diplegia, paraplegia, or idiocy, with or without paralysis. The paralysis which date from cerebral hemorrhage at birth are mostly more severe than those which follow hemorrhages in older children. Cerebral hemorrhage apart from a meningeal bleeding, when it occurs during early life, takes place in 'bleeders,' and often as the result of a blow.

Post-partum Meningeal Haemorrhage. Birth Palsy.—A delayed labour from any cause is liable to give rise to asphyxia, the vessels of the pia mater being gorged with dark venous blood, and a leakage takes place, the blood oozing from the distended vessels. The damage done by the pressure of the clot forming on the convex surface of the brain may be sufficient to permanently injure the cerebral motor or other cortical centres. The newly born infant's brain is exceedingly soft and readily injured, as anyone knows who has attempted to remove one *post-mortem* without damage; if the slightest injury is done to the brain by the saw in dividing the skull, the brain substance will ooze out of the saw-cut almost like clotted cream. Now, not only may a considerable damage be done to the brain by a comparatively small surface haemorrhage, but as the cortical centres are imperfectly developed at birth, the pressure of a clot or a rupture of the grey matter may readily prevent growth and development. The consequences of this brain damage are various, but are often not very apparent for some months or more after birth. The mental powers may never properly develop, though the limbs are strong, and the child is mentally weak or an idiot; or the lower extremities are stiff and weak, or there is a paresis of hemiplegic distribution, the child generally also being mentally deficient. In all a history of a prolonged labour, or of being 'born blue,' can be obtained.

A whole family is often more or less affected when the mother has a narrow pelvis, or for various reasons has difficult labours; some of the infants may escape if born before they are fully developed. First-borns are apt to suffer the most, as can be readily understood.

The following history of a family may form an illustration of the damage which may be done by difficult labours. Mrs. G. has always difficult labours

in consequence of a sarcom polio. She has had seven children born at a four till time.

1. Willie, eight years old, suffers from spastic paraplegia and is mentally deficient (figs. 93 and 94). (An inmate of the Royal Albert Asylum.)

2. John died at thirteen months of convulsions; head never was right.

3. Clara, six years, is all right.

4. Baby, died soon after birth.

5. Baby, born dead.

6. Boy, two years old, is all right.

7. Girl, four months old; both legs semi-rigid, exaggerated tendon reflexes, ankles rather stiff.

In this family of seven, two appear to have escaped entirely; of the remaining five, two are living, having sustained a brain damage, and three are dead, their death no doubt being directly due to a birth-stroke in the brain.

Symptoms.—The most common symptom which immediately follows the meningeal hemorrhage is convulsions; sometimes there is paralysis, and these may be rigidity. In the great majority of the cases there is no marked paralysis immediately following birth, or at any rate it escapes the mother's attention, and it is only at the end of the first year that it is noticed there is stiffness about the child's legs, which prevents it from walking or from making any attempts to walk. Mostly, however, when the infant is a few months old, a careful examination of the lower extremities will reveal an exaggerated knee-reflex and a stiffness of the ankle joints. In some cases there is overaction of the adductors of the thighs, so that the legs are constantly crossed, with probably also more or less talipes equino-varus. Both arms may be affected, or an arm and leg only; there is usually backwardness in talking. When the symptoms are fully developed, as they usually are at two or three years of age, the rigidity of the limbs, most frequently the legs, is very characteristic; there is 'spastic paraplegia'. In a severe case the child cannot walk or stand unaided, and lies helplessly in bed; the knees are semi-flexed, with adductor spasm, the tendo Achillis is drawn up, so that the foot is in a position of equino-varus, there is exaggerated knee-reflex, and ankle clonus. In some instances the child, though unable to stand or walk without help, on account of the talipes equinus present, can crawl, and may learn to do this fairly well; this was the case with Willie G. (see fig. 93). This condition may remain throughout life, and occasionally adults belonging to this class may be seen crawling in all fairs in the streets, and gaining one livelihood by begging.

Many, perhaps the majority of cases, learn to walk in some sort of a fashion, but with difficulty, on account of the spasm of the gastrocnemii and the consequent tendency there is to fall forwards, and the awkwardness and want of control over their movements. The arms are more rarely affected than the legs; sometimes there is slight rigidity in one only or in both, which interferes with their use, or the elbow is fixed, the wrist flexed and pronated, and the fingers fixed at the metacarpophalangeal joints. There may be present the irregular movements known as *athetosis* (see p. 477). Sometimes there is slight facial paralysis, only noticeable when the child laughs or cries; we have never seen it well marked.

The child is usually backward in talking, and in some cases where the mental defect is marked they never can utter anything but meaningless sounds. The mental condition varies; sometimes there is complete idiosy, more often some loss of intelligence, or the child is emotional, being easily roused to anger, and, if going to school, is teased and tormented by its companions. The shape of the head is often altered; occasionally, it is small and more or less flattened in the parietal regions.



Fig. 33.—Spastic Paralysis, the result of Meningeal Hemorrhages at Birth. Willie G. aged 4 years. The weight of the body is partly supported by being held up by the arms, partly by resting on the feet.



Fig. 34.—Willie G., 1862, division of the body. Atrophy and bowed arms shown.

Cerebral Hemorrhage occurring after Birth. Acute Cerebral Palsy.—Cerebral hemorrhage may occur from various causes besides those in operation during the act of birth. Blood may ooze on to the surface of the brain or into the white or grey matter during over-distension of the cerebral veins from any cause. The commonest cause is a series of convulsions. Hemorrhage may occur, however, during whooping cough, or in severe vomiting, or in any cases in which there is a severe venous congestion of the brain. We have several times seen *post mortem* a meningeal bleeding

or infants who have died in convulsions, and also after whooping cough. Such hæmorrhages are most common during the first two years of life—in fact, they are uncommon at any other period, and this is to be expected when we remember how much more delicate the capillaries and cerebral veins are during infancy than in later life.

The convulsions which immediately precede the hæmorrhage may be the result of many different conditions. Sometimes the primary illness is measles, acute diarrhoea, pneumonia, whooping cough, or scarlet fever; more often, perhaps, the attack cannot be referred to any one of these, and the principal symptoms are high fever and drowsiness, and then the convulsions supervene; then, after a series of convulsions, a more or less well-marked hemiplegia is noted. Such cases are often looked upon as 'brain fever' or 'congestion of the brain.' In some cases there is a history of a fall. In other cases the convulsions are undoubtedly reflex, especially from colic. A high temperature, 105° to 106° , seems to excite convulsions.

In all cases we have noted the convulsions were severe, often unaided at first, but tending to become general; they may last from a few hours to a week; the infant may remain a long time in a state of coma. Probably a small amount of bleeding may take place without producing any symptoms, and absorption takes place and no ill effect remains. In others there may be a slight and transient paralysis of an arm or leg or both, such as is sometimes seen after an epileptic fit. In another class no paralysis is left, but the child grows up with feeble mental powers which date from the time of the convulsions. In a common class of case a more or less complete hemiplegia or diplegia is left, with perhaps more or less facial paralysis.

As an instance of reflex convulsions giving rise to cerebral hæmorrhage we may relate the following case:

Convulsions; Cerebral Hæmorrhage.—George L., aged 14 years, was brought to the Children's Hospital, Manchester, suffering from tuberculous and also hæmiplegia; his mother gave the following history. He was strong and healthy when born, though the labour was somewhat tedious. There was no history of hereditary syphilis. He walked at twelve months of age, and was well and strong till two years of age. At this time he had a fit, which was attributed to his eating some fruit of apple pie some half an hour before the attack. He was playing on the doorstep at the time, he suddenly became 'black about the mouth,' and would have fallen but for another boy who caught him in his arms. The fit, including the unconscious state which followed, lasted about ten minutes. Two weeks after he had another fit, which lasted half an hour, and was more severe than the first; his right arm and leg were especially convulsed. After this fit (ten days) that his right arm hung motionless, and in trying to walk he dragged the right leg. The face was unaffected. The arm was always worse than the leg; at first he could not hold anything in it. Both arm and leg slowly improved, but have remained more or less stiff and rigid. Ever since the first convulsion he has been subject to fits, but he has not had one for the last two years. He has had on an average two fits a week from two years of age till he was ten years. They only lasted some minutes, accompanied by loss of consciousness; he always knew when a fit was coming by his right thumb beginning to 'work.' He used to say, 'Mother, my thumb's swelling,' then he would fall over almost immediately if not caught. The fits were mostly right-sided, but the left arm and leg would also 'work.' Lately he has used his right arm more than formerly, being able to hold things in it.

When examined (September 8, 1891) it was evident he was affected with an old hæmiplegia; he could walk, but dragged his right leg after him. He could see his right arm for holding things, but could not find himself with it; the shoulder joint was fairly

movable, the elbow bent and semi-rigid, and the hand protruded; the stimulus could be overcome by slight force. The right leg was somewhat stiff at the knee and slightly bent as he lay in bed with the foot pointed. There was exaggerated knee reflex on the right side. There was no evidence of any mental weakness.

He died of tuberculosis in February 1911. The post-mortem was made by Mr. R. O. Bowen, senior resident medical officer at the Children's Hospital; on examination the brain was dry. An examination of the inner surface of the brain showed it to be perfectly normal, the membranes were healthy, there was no flattening of the convolutions or any evidence of an old cerebral hemorrhage. The normal parts were examined by making transverse sections. The first section taken through the centrum ovale showed nothing unusual. A section made exposing the lateral ventricle, without slicing the corpus callosum, showed an old cyst (fig. 55, a) with brownish contents, $\frac{1}{2}$ inch in length.



Fig. 55.—Horizontal Section of Brain, exposing lateral ventricle (a b), lower of Rolando; a, old blood cyst; b, b, b, c, small blood cysts. Hemorrhage at two years of age; death at twelve years of age.

located on the left side in the white substance between the fissure of Rolando and the corpus callosum; and four small cysts b c situated on the right side in the white substance. The cyst marked a was apparently about $\frac{1}{2}$ inch in depth. There was no tubercle or induration in the neighborhood of the cysts. A third section made lower than the above, and on a level with the upper surface of the cerebellum, and along the optic thalami, crurae cuneata, and internal capsule (fig. 56), showed the lower limit of the cyst seen in fig. 55, a second old blood cyst b, and another small one at c. Another similar cyst was found in the white substance of the frontal region at a lower level than fig. 56.

Sections of the cord, made in the cervical, dorsal, and lumbar regions did not show any tubercle or swelling of the descending roots; neither was there any swelling of the motor capsule or crura.

In reviewing the history of the case, in the light of the post-mortem, there is much reason to believe that a multiple hemorrhage took place when the boy was two years of age, and that one or more (A, fig. 35) of the hemorrhages gave rise to the paralysis by the destruction of some of the white fibres *in transit* from the motor-surface centres to the internal capsule. There seems to be little room for doubt that the initial contractions were the cause and not the consequence of the multiple hemorrhages. It is hardly conceivable that the multiple hemorrhages should be caused by any thrombosis, embolism, or arteritis; they must presumably have been due to a



FIG. 36. Coronal Section through Brain at a lower level than Fig. 35, showing typical Hemorrhages and Caudate Nucleus (A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z).

sudden engorgement of the veins due to asphyxia, such as takes place in it in consequence of spasm of the respiratory muscles.

As an example of a hemiplegia following convulsions associated with measles the following case occurring in a healthy boy of twenty months, a patient of Mr. Wilson of Cheshire, which came under our observation, may be taken as an example. Mr. Wilson's notes are as follow:

Measles, Pneumonia, Convulsions, Hemiplegia.—Boy, twenty months. The measles was first noticed on May 10; convulsions commenced at noon on the 11th. This consisted of clonic spasms of the left arm and leg and right side of the face; the eyes were turned to the right side and fixed; the pupils were dilated; the temperature rose to 102°; the pulse was 120 (as he counted); the convulsions continued during the evening; at 7 P.M. the temperature was 103° F., when the patient was put into a cold bath; it rose again 102° at 4 P.M., when he was bathed again and five grains of quinine given. By the next day, on the 13th, the temperature of the lungs showed pneumonia (as he counted); at 6 P.M. the temperature was 103°, and the mother noticed he had lost the use of his left side; at

8 A.M. it was noticed that the left arm was completely flaccid, paralysed, and appressed to the side; the leg was rigid, but on talking the sole of the foot the toes moved slightly. *Paralysis* developed the next day: the child died on the 29th, the arm and leg remaining in the same positions; unfortunately, no autopsy could be obtained. The paralysis was probably due to a surface bleeding following the convulsions.

The following case may be given as illustrative of one which recovered from the immediate effects of the acute attack.

Case-history. Hemiplegia.—A child of thirteen months, who was during her latest illness weak, was suddenly seized with vomiting, diarrhoea, and high fever; then a series of convulsions came on which lasted eight hours, the right side working more; at the end of the time it was noticed she had completely lost the use of the right arm and leg, and the face was drawn. Her speech was affected, so that she could not say any of the words she had learnt. For more than a month she lay quite helpless. Seven months afterwards, when twenty months old, she could not walk as yet for her weight on the right leg; the arm was bent at the elbow, the hand clenched, but the facial paralysis had disappeared; she could say a few words, but was backward in intelligence. At the age of four years she had much improved: she could walk quite well, having acquired regained power in her leg, though there was slight equino-varus, but the right arm remained stiff and weak, the elbow fixed, the wrist bent and pronated, and the fingers clenched. The fingers closed spasmodically, so that she was in the habit of picking things up with her left hand between the fingers of her right, when they were held without effort. She could talk and was very intelligent.

These cases may be taken as types of acute cerebral paralysis due to cerebral hæmorrhage; the symptoms in such may be varied, but they all three agree in that convulsions were present and the paralysis set in suddenly and unexpectedly, as a surprise to the attendants. In the second and third there was high fever.

For the succeeding few weeks, if the patient survives, he remains helpless, though the condition gradually improves; if there is anæsthesia, this passes away; the aphasia, if present, disappears; the face improves, and still more or less power returns in the muscles of the legs. The arm remains in part permanently paralysed, and in the course of some months contractures come on; the greatest improvement takes place in the muscles about the shoulder; the elbow is fixed, the wrist flexed and in a position of pronation, the fingers are bent up, inclining the thumb. The amount of paresis and contracture varies considerably, according to the severity of the case. Peculiar movements often occur in the paralysed limbs, more especially in the hands, a condition to which the term 'athetosis' has been applied. The movements as a rule are quite unlike chorea; they are slow, consisting in alternate contraction of opposing muscles, giving rise to irregular movements of the fingers and hand; they are involuntary, and take place in muscles in which there is ordinarily a certain amount of tonic spasm. The term 'mobile spasm' has been applied to this condition by Gowers. As the latter author points out, the interossei and lumbricales muscles (which flex the metacarpophalangeal and extend the phalangeal joints) are mostly affected; less often the long extensor, and never the long flexor of the fingers.

In consequence, the hand is apt to assume the interosseal position. The movements may take place independently in the interossei, so that one or more fingers may be extended at a time, or all the fingers may be extended and separated, and the slow irregular movements of the extended fingers suggest the movements of the tentacles of a coffee-fish (Gowers). The

movements are involuntary, but are made worse by attempts at voluntary movements.

The paralysed arm is apt to grow more slowly than its fellow, so that it is shorter and smaller, and often blue and cold. The leg, following the usual course in hemiplegia, recovers more quickly and perfectly than the arm: there is more or less *equino-varus*, and there may be some shuffling, but the child can get about fairly well.

The intelligence often remains impaired; sometimes there is complete idiosy, more often only impaired mental powers or backwardness. Epilepsy is also common.

Post-mortem.—If an opportunity occurs of examining the brain shortly after the occurrence of the hæmorrhage, blood varying in amount from a puriform hæmorrhage to a large clot or clots will be found beneath the pia, situated most commonly at the vertex, but also at times at the base: it is usually double, but mostly more extensive on one side than the other. Blood does may also be found in the central white matter, or in or about the masses of grey substance at the base. There may be actual destruction of brain substance as a result of the bleeding, and probably in most cases softening follows.

If death occurs after some years, atrophic changes of varying amount will be found, or there may be old blood cysts, if the bleeding took place into the brain tissue. In cases in which there has been a hæmiplegia or diplegia, the atrophic changes are situated in the motor area. The dura mater may be adherent and the pia mater thickened over this area, and instead of fully developed convolutions in the ascending frontal and parietal regions a scarring or cicatrization has taken place, no doubt as a result of the softening taking place after the hæmorrhage. This was the case in the brain of a boy recently under the care of our colleague Dr. H. R. Harrison (see fig. 97), and also in a case recently shown by Dr. T. R. Railton at the Manchester Pathological Society.¹

In Dr. Harrison's case the skull was thickened and flattened over both parietal regions, there was agenic diplegia, the infant was an idiot. At the *post-mortem* the dura mater was found to be adherent to the skull, the pia thickened over the motor area and adherent, a well-marked depression or sulcus being present over both motor areas. In some cases atrophy of the frontal or occipital lobes has been found as a result of the old hæmorrhage.

Treatment.—In connection with the treatment of *post-natal* cerebral hæmorrhage, the most important matter is to prevent its occurrence by so expediting labour, that the infant does not suffer from asphyxia. Much may be done to prevent, very little can be done in cure. We are powerless—as far, at any rate, as drugs are concerned—to remove a cerebral clot or undo a brain damage. Hence the question of immediate trephining to remove the blood deserves consideration, and will probably be in the future a recognized mode of treatment in cases where the hæmorrhage is local and superficial. In these cases in which the bleeding is secondary to convulsions, the most important matter is to prevent any further return of the convulsions; to this end the bromides and chloral must be used with a very free hand, and pushed so as to render the infant drowsy. It should be applied to the head, and

¹ See *Medical Chronicle*, March 1890, p. 120.

the head and shoulders kept well raised. A moderate purge should be given, sufficiently large to act freely on the bowels; a piece of mustard leaf may be applied to the back of the neck if the child is unconscious, care being taken not to leave it on long enough to produce a sore. The drugs most likely to be of service are small doses of digitalis, to steady and increase the power of the heart, and bromide in full doses if there is any tendency to convulsions. The paralyzed limbs should be wrapped in cotton wool. As the patient is recovering from the effects of the attack, tinct. cornica, iron, and syrup of the hypophosphites may be given. In the later stages, when contractures are setting in, massage should be diligently and intelligently employed; but the patient's friends must be warned that a cure is not likely to be effected by



Fig. 32.—Brain from a boy aged 11 months, showing, *a*, depression over left motor area, due to hemiplegic hemorrhage at birth; *b*, cerebellum only partially covered by the occipital lobe. The patient had a typical spina. (Dr. W. K. Hunter, Esq.)

any form of treatment, and that rubbing, as also galvanism, is only palliative. Every effort should be made to bring out the patient's voluntary power. The deformities resulting may be improved by division of tendons and the application of splints.¹

With regard to prognosis, it is well to give a carefully guarded opinion as to the future. Nearly all cases improve, and slight palsy recover quite well. Severe cases improve as years go on, but it is doubtful if they ever completely recover. In the majority of cases there is some mental debility, either a mere backwardness, or there may be decided idiocy. Some cases become epileptic.

Medullary Hemorrhage.—In speaking of hemiplegia and of the

¹ J. L. Wilbur, *Trans. American Orthop. Assn.*, September 1891.

hemorrhagic diathesis we have mentioned the fact that a cerebral hemorrhage may occur in these conditions after a slight head injury. We have related such a case (p. 370), and referred to some cases related by Stollon. The following case is a rare one belonging to the same category.

Hemophilia; Melancholic Hemorrhage.—Noble M., age 5 years 12 months. Family history good. Father ten years before suddenly lost the hearing in one ear, which was supposed to be due to hemorrhage. Patient had a sharp attack of measles four months before, followed by glandular abscesses eight months ago. For the first year it had been noticed that she had exhibited a tendency to "bruise," purple spots appearing on the skin after the slightest injury. She was a well-nourished child, but had always been difficult to feed. She was quiet and till the morning of December 29, when she refused and refused to eat; there was no history of a fall, but she had been in a children's party the evening before and had tramped a good deal. The following day she was seen with Dr. Latham; it was then noted she could not stand or sit, and when held up her head fell to the right side.

There was slight paralysis of the left side of the face, including the orbicularis; but the eye could be closed; the voice was weak and had a nasal twang; on attempting to swallow, she coughed and spluttered as if some of the food entered the lungs. There was no cardiac murmur. Temperature of December 31.—She had recovered some power in her legs, and she could sit up, but her head still fell over to the right side. It was noted that her breathing was peculiar, the right side of the head was moving extremely



Fig. 97.—Frontal section of skull showing involvement of the brain tissue.



Fig. 98.—Transverse section of skull showing involvement of the brain tissue. The right alveary nucleus, root of right optic nerve, and base of fourth ventricle. r, raphe; v, longitudinal tract, vent.

while the left side was hardly moving at all; this was noted on both sides. December 31. The swelling was better, but it was noted the lungs were getting enlarged, as the ribs were heard freely all over, the right side still moving more freely than left. Temperature 101°. The child became more and more sickly, the respirations increasing in number; then convulsive convulsions, and finally death from asphyxia on the evening of December 31. Post-mortem (third day).—No cerebral hemorrhage except in the meninges, where it was noted that the right side of the meninges was swollen and discolored (see fig. 97). A transverse section (after kindling) through the middle of the alveary bodies, a round hard spot $\frac{1}{4}$ inch in diameter was found, which had compressed the root of the right optic alveary nucleus, and also the nuclei in the lower part of the floor of the fourth ventricle (see fig. 98).

We are indebted to Dr. R. T. Williamson's microscopic examination of the case. He found no evidence of any constitutional taint.

Embolism.—Among the various causes producing a paralysis of hemiplegic distribution we must mention embolism. Embolism chiefly occurs in patients suffering from endocarditis, but also it appears to occur at times

when there is no form of heart disease present, the thrombus appearing to form in the left auricle or pulmonary veins. Embolism is perhaps most common in acute or malignant endocarditis; this was so in the case recorded on page 398 (see fig. 100).

In the following case there was hemiplegia in consequence of a blocking of the middle cerebral artery, either from embolism or thrombosis:

A boy of one year old, who had suffered some little from scarlet fever, but no destructive pulmonary disease (fig. 98 represents the heart of this case and constant deposits were noted over right with weakness and consciousness followed by paralysis of the left arm and leg. When seen on the following morning, the head and neck were turned to the right side, the eyes were inflated and looking on a small foreign body was present, the right pupil was smaller than the left, but both acted to light; the mouth was symmetrically quite closed; there were no retinal hemorrhages, and the optic discs were



FIG. 98.—Coronal Section of a Brain, showing patch of softening involving the left hemisphere, anterior and anterior limb of the internal capsule. The large sub-arachnoid space was present with its contents well exposed. There was considerable flattening of the right side. (From p. 107.)

normal. The face was drawn to the right side; there was complete loss of power, and completely loss of sensation, in both arm and leg of the left side. No cry could be elicited on pinching or pricking the skin of either limb. The child was thirsty, but not unconscious, as he appeared at times to know the position when he fed him. He was apparently deaf for the first twenty-four hours, though there was presumably some difficulty in ascertaining this; by the next day, though weakness remained, he knew the voices of his friends, and turned towards the direction of their voices; it was long, also, that he heard with both ears. Within a fortnight sight had returned, so that he could recognize his mother and his toys. His hands though he regained his sight first in his right eye. By the end of six weeks sensation had returned, as far as could be judged, in the arm and leg, and some power was returning in the mood both limbs of the left side. A week or

two lower incisors held a rattle in the left hand, but not raise it to his mouth; the leg showed a tendency to draw up, and the lower reflex was much exaggerated. The mind was quite intelligent and bright. The first death (seven months after seizure) much improved, went back to place; the child could put out his hand, but there was some rigidity both in the arm and leg. The child died of bronchitis. *Post-mortem*.—On opening the trunk, it was evident the right hemisphere had shrunk, being slightly smaller than the left, and that there was a large cyst (pericystic), containing clear fluid, occupying its central part of the convexity of the right hemisphere (see fig. 104); the cyst corresponded with the distribution of the middle cerebral artery, occupying the branch to the inferior frontal convolution. The middle cerebral artery beyond its first branch was intussuscepted, and contained old clot. It was quite clear in this case that there had been thrombosis in a branch of the middle cerebral, with a subsequent softening of the area supplied by it; a horizontal section showed that the internal capsule had been compressed.

No emboli were found elsewhere; there was no endocarditis of the mitral or aortic valves, but a much contracted pulmonary artery and open branch cavae.



Fig. 104.—Brain found by softening of brain substance secondary to distension of the middle cerebral artery beyond the first branch (the inferior frontal convolution). The case will be referred to in chapter of the convulsions. Child thirteen months old; death seven months after onset of paralysis.

Dr. F. Taylor records a typical case of embolism following erysipelas:

A boy of five years, two weeks after an attack of infant fever, had swell with two plugs of the right side; the urine was albuminous. Death occurred from diphtheria nine weeks afterwards; embolism of the left middle cerebral artery, with extensive softening of the left hemisphere, was found. There was endocarditis of the aortic valve.

Abercrombie reports a case of a boy aged six years who was under treatment for diphtheria, and who on the fifteenth day was seized with general convulsions and left hemiplegia; he died eleven days later. The middle cerebral artery was found plugged with an embolus; infarcts were also found in the spleen and kidneys. There was an brain disease, and it was difficult to understand the source of the emboli, unless formed in the cavity of the heart or in the pulmonary veins; this might be possible in periods of the respiratory reaction and disturbed innervation of the heart, following diphtheria.

Dr. Trevelyan reports a similar case to Dr. F. Taylor's, in a girl aged eight years convalescent from diphtheria.

A sudden hemiplegia may be caused by meningitis, the immediate cause being softening following thrombosis or embolism of the vessels; the meningitis is usually tubercular. Thus a boy of six months of age, who had been apparently healthy, suffered for a week or two from febrile disturbance, dyspepsia, and irritability, attributed not unreasonably by his friends to 'nothing'; one evening at 8 P.M. he was convulsed, the right arm and leg trifling most; this was followed by right hemiplegia, including the face. At 7 A.M., when seen, the infant was unconscious, with contracted pupils, Cheyne-Stokes respiration, the face drawn to the left, the right arm and leg completely powerless. Death took place three days later, the temperature rising in the meantime to 105°. The *post-mortem* showed a basal meningitis (tubercular), much fluid in the lateral ventricles, and softening of the left hemisphere and corpus striatum.

Another lesion (this a rare one) giving rise to hemiplegia is an aneurism of the middle cerebral artery, the result of embolism, in cases of acute endocarditis; this was the case in a girl of nine years under our care who suffered from intermittent pyrexia and albuminuria, and in whom a loud systolic murmur was present. To these symptoms was added acute pain in the frontal region, coming on suddenly. An ophthalmoscopic examination showed large cerebral hemorrhages surrounding the disc. A week later there was paresis of the right arm, no paralysis, but exaggerated tendon reflex of the right leg. Six weeks later she fell back unconscious while sitting up in bed: there was now right facial paralysis, and paralysis of the right leg. Death followed ten days later. An aneurism the size of a small walnut, on the second branch (to the ascending frontal convolution), near its origin from the trunk of the left middle cerebral artery, which had ruptured and given rise to meningeal hemorrhage, was found *post mortem*.

Thrombosis of the Cerebral Sinuses and Veins.—Thrombosis of the cerebral sinuses or veins is not a common occurrence during infancy and childhood. It may occur in the superior longitudinal, lateral, or cavernous sinus. It is most likely to occur in extreme anemia, after exhausting diseases as acute diarrhea, where the force of the heart is weakened and a stasis or slowing of the venous current takes place. Thrombosis may also occur in the surface veins under similar circumstances, or the clotting in the veins may be the result of meningitis. The immediate result of the obstruction to the veins or sinuses is to distend the venous branches behind the obstruction to their utmost capacity, and possibly also to give rise to punctiform hemorrhage and softening of the brain. Thrombosis of venous channels may take place in the neighbourhood of some inflammation, as in otitis, and pyemia may result.

Symptoms.—There is a condition of great exhaustion and pallor, and to these are added cerebral symptoms and venous obstruction. The fontanelle is tense, the veins of the forehead, nose, and face are distended; there is epistaxis and probably convulsions; perhaps, also, rigidity and immobility of the neck, and paralysis of one or more extremities. In making a diagnosis, it must be remembered that the so-called 'false hydrocephalus' or cerebral anemia gives rise to convulsions, stupor, and coma, and is infinitely more common than thrombosis. We are only justified in diagnosing the latter when there is distension of the veins of the face and forehead, or some

definite paralysis. Thrombosis of the cavernous sinus is more likely to occur in some local lesion, as a tumor, as a periosteal sarcoma of the upper jaw, or caries; the eyeball is prominent, there is oedema of the eyelids and distension of the veins of the forehead.

Treatment.—The action of the heart must be strengthened by digitalis and digitalis, and the tendency to exhaustion and syncope must be combated by beef tea and highly concentrated forms of nourishment. The patient should be kept in the prone position as much as possible, with the shoulders and head raised. The prognosis is necessarily extremely grave.

Arteritis, Endarteritis.—An acute arteritis in rare instances occurs in infants a few months old who are the subjects of congenital syphilis. Such cases have been recorded by Dr. T. Barlow, Chalm, and Hershner. Arteritis also occurs in syphilitic infants of all ages, accompanied in some cases by pachymeningitis and sclerosis of the brain.¹

In infants, the principal symptoms are convulsions, in the form of muscular twitchings of an arm or leg, followed by paresis and contracture. The infant gradually becomes idiotic. The chief changes are in the arteries as described by Heubner: there is a thickening of the internal coat, the nuclei between the endothelium and the fibrillated membrane becoming increased in number, to be followed by fatty changes; thrombosis takes place at the seat of the inflammatory changes. Softening of the brain follows over the area supplied by the blocked arteries. The following case illustrates this.

Syphilitic Arteritis. Softening.—Infant first seen at three months of age, when suffering from rickets and a well-marked rash. A month later the epiphyses of the lower and all the ribs and ilia, also the lower ends of the radius and ulna, were swollen and tender (fig. 35 was drawn from this case). When seven months old he began to suffer from convulsions, mostly tetanoid at first, later the convulsive movements became general. In the course of a few months the left arm and leg, which were more or less paralyzed, began to draw up and become more or less rigid: the elbow was bent at right angles, the arm pronated, and the fingers flexed; still later the right arm became similarly affected; the child gradually became idiotic, and died at four months old. It was under no medical treatment from three months of age. At the post-mortem the arachnoid was of a milky white, but there was no mass of serous or fibrinous fluid; there was no effused lymph or meningitis. The superficial layer of the grey matter on the convex surface of both hemispheres, especially the right, was softened and could be readily scraped away; the superficial layer of the dentate nucleus and optic thalamus were in the same condition of softening. Microscopically, the grey matter showed extensive fatty degeneration; the nuclei of the cells were sometimes blocked with oil droplets, their inner coils being fractured and the nuclei increased in number. The large arteries were normal, as far as could be made out. There seems to have been an extensive syphilitic arteritis of the small average-capsule arteries, thrombosis, and secondary softening of the superficial grey matter.

¹ J. S. Burry, M.D., *Annals*, April 1884.

CHAPTER XXI

DISEASES OF THE NERVOUS SYSTEM—continued

Chorea

CHOREA is a disease which occurs chiefly in children between the ages of six and fifteen years, and is characterised by irregular spasms of the voluntary muscles, and in some cases by paroxysms of the extremities and mental weakness.

Ætiology.—Chorea can hardly be said to be hereditary, but undoubtedly a tendency to nervous or 'weak nerves' runs in families, and instances might be adduced of emotional parents having children who suffer from chorea; moreover, it is a common experience to find several sisters or brothers suffering from chorea, or perhaps one or more are neurotic or hysterical.

Chorea is not common before the age of six years, and after the age of fifteen years the liability to attacks becomes very much less. It is more common in girls than boys, in this respect resembling hysteria and other emotional diseases. Analysing 633 cases which have attended in the Children's Hospital, we find that 454 were girls, and 179 were boys, giving a proportion of five girls to two boys; these figures closely correspond to the statistics collected by other writers.¹ In 252 cases the ages of the patients were analysed, giving the following result:

Under six years	15 = 3 boys and 12 girls
Between six and ten years	102 = 33 boys and 69 girls
Between ten and fifteen years	135 = 44 boys and 91 girls

The youngest child was a girl of four years of age.

The children most apt to suffer are the nervous and excitable, those who are easily frightened, especially if they are suffering from ill-health, the result of unfavourable life-conditions or rapid growth.

By far the commonest exciting cause is a fright; in 38 cases out of 252 there was a definite history of the patient being frightened, the symptoms following in some cases next day, in others within a few days or a week. The causes of the fright were various; in one case, that of a boy, the symptoms followed three days after seeing a 'man with his throat cut'; sometimes the attack was ascribed to a 'dog having flown at the child,' or the patient was 'frightened by a policeman,' or the child had been camed by the school-mistress, or had had a fall down stairs. In such histories there is often something it is necessary to discount: probably the scoldings at school were the

¹ See Tugger's *Principles and Practice of Medicine*, edited by Pye-Smith. 2nd edn.

consequence and not the cause of the chorea; but, on the other hand, it is certain that chorea may follow within a few hours of a serious shock to the nervous system.

Mental strain, as working hard for an examination, in some cases appears to excite an attack; this has occurred too often in our experience to be attributed to any mere coincidence. Given a fast-growing and delicate girl, of amiable disposition, and not too well fed, who is at school for many hours during the day, and has to divide her attention between home lessons and various domestic duties, so that she becomes little else than a drudge, it can hardly be surprising that she suffers from a nervous breakdown. 'School-made chorea,' as Dr. Sturges calls it, is not by any means confined to the poorer classes, and, although among the better-made classes there is no question of poor food and household drudgery, yet there is often much being expected to induce a girl, of perhaps delicate health, to keep pace with or run ahead of her stronger and more robust class-mates.

In some instances children who are convalescent from various depressing diseases, such as acute rheumatism, enteric fever, or scarlet fever, are attacked with chorea. Rheumatism excepted, enteric fever in our experience more often than any other disease predisposes to chorea; other serious disorders, such as diphtheria, scarlet, and aplasia, are not uncommon after enteric, and are no doubt due, as is also the chorea, to the anemia and exhaustion caused by the long drain on the system during the disease. For the connection of rheumatism with chorea, see p. 480.

Heart disease in some instances precedes the attack of chorea, or, in other words, chorea makes its appearance in children suffering from cardiac disease.

It sometimes happens that a source of irritation in some part of the body is the exciting cause of an attack of chorea; thus we have seen a temporary chorea occasioned by suppurative inflammation in the middle ear, the choreic movements ceasing when the discharge made its appearance. In other cases it happens that chorea is an early symptom in pericarditis—thus we have also seen in one case, in a little girl of four years, choreic movements preceded by a few days the physical signs of a pericarditis which proved fatal. We cannot help thinking that in such a case the chorea was symptomatic of the pericarditis, the latter being the primary lesion, rather than that the heart lesion was secondary to the chorea.

Influenza in some cases seems to be a factor in the production of chorea. On one occasion five cases occurred in a girls' school immediately after the admission of a child suffering from chorea; in such cases, perhaps, it may not be imitation so much as fright at seeing others affected, as Gowers suggests. We have never known children in the same ward become choreic in consequence of a bad case being admitted, but we have seen cases of chorea apparently made worse by association with a bad case.

Symptoms.—Most of those who suffer from chorea are in some way or other weakly, or at least not in robust health; they are often anæmic, equally growing girls. Not infrequently, it occurs in girls who have gone out to service, and who are undertaking work which is beyond their strength. Often the first symptoms are a loss of control over the muscles, especially the flexors and extensors of the fingers and wrists, and a want of precision in the movements of the hands. The patient drops cups and saucers on the floor;

is unable to do needlework, fumbles sadly when she attempts to eat a piece of meat, or spills her food when she passes it to her mouth. Sometimes, especially in younger children, the first thing noticed is that she makes faces, her mouth screwing up so as to make grotesque grimaces, while she fidgets with her fingers, and when she attempts to dress herself makes useless, clumsy, ineffectual movements. All this may go on for many days, perhaps weeks, without the friends thinking the child is really ill, and perhaps she gets scolded, both at home and at school, for her clumsy ways and inattention to her work. It is needless to say the scoldings do no good. Sooner or later the movements become too obvious to escape attention: indeed, it is apparent to everyone that something is wrong. These movements, as Dr. Sturges points out, are much more vigorous in the upper part of the body than the lower, the hands suffering most of all. The fingers are opened and shut, the extensor and flexor muscles being constantly worked; the arm is pushed behind the back, then brought to the front: if asked to shake hands, it is thrust rapidly forward, being directed with difficulty to the hand to be grasped. The tongue is protruded with a jerk, and perhaps drawn back again in a moment with a quick movement. The muscles of the face are frequently spasmodically contracted, so that queer grinning grimaces are constantly being made. The muscles of the neck are frequently contracted and relaxed, so that the head is moved from side to side or rotated. When the child walks, the feet join in the spasmodic movements, so that the gait is altered, the legs being thrown forward quickly, or if the patient stands the feet are restless, being shifted about from place to place. When the patient is at rest in bed she will lie still if not disturbed, but directly she is interfered with—as, for instance, to examine the chest—the movements begin, the hands, face, and trunk muscles being thrown into a state of clonic spasm. The muscles of respiration do not escape—the child takes a deep-sighing inspiration, then perhaps there is a series of shallow irregular respirations. The irregular respirations may affect the pulse, so that it is irregular and intermittent. The movements cease during sleep, though sleep is not readily obtained; indeed, in the worst cases the patient only sleeps when under the influence of chloral or opium, which has to be freely given in order to secure rest. In the milder cases the movement may be confined to one side; this, however, is never the case when the movements are severe, though it is very common to have the clonic spasms more vigorous on one side than the other. A **hemichorea**, in which the movements are vigorous and entirely confined to one arm or leg, is probably due to some organic cerebral disease.

The temperature is usually normal throughout, sometimes subnormal: if there is any fever, pericarditis or rheumatism should be suspected. In the most severe cases the temperature may be raised a degree or two.

There is often marked paresis of an arm or leg, far more commonly the former: not only is the grasp feeble, but the arm is weak and powerless, though complete, or indeed well-marked, paralysis does not occur. This paresis of an arm is sometimes the most prominent feature in the case, but in all cases more or less of clonic spasm may be detected in the fingers or in the facial muscles. These cases have been spoken of as 'paralytic chorea.'

The *electric irritability* of the muscles in cases of hemichorea has been studied by several observers, most recently by Gowers, cases of hemichorea

being selected on account of the possibility of comparing the muscles of one side with the other. In some cases no difference can be detected, but in others there has been noted an increase of irritability on the affected side, the muscles contracting with a weaker faradic and also voltaic current than those on the unaffected side.

The speech is affected, in some cases from the muscles of the tongue, jaw and larynx not being under efficient control. In other cases the mental weakness frequently present may be the cause. Headaches are often complained of; sometimes, especially in cases of 'hysterical chorea,' there is hyperæsthesia or anaesthesia.

Ophthalmia has been observed by Gowers, slight in degree in some cases; in one case there was a sufficient degree to make it comparable to the neuritis seen in a case of cerebral leucoma. In the vast majority of cases there are no ophthalmoscopic changes.

The mental state is often peculiar. There is a vacant, listless expression on the face, in many cases a dullness of comprehension. The child may cry on the slightest provocation. There may be actual dementia, or, on the other hand, morbid excitement.

In the worst cases the movements are severe; the child constantly wriggles about, and the arms and legs move sufficiently violently to throw the patient out of bed. The constant movements of the limbs chafe the skin on the extensor surfaces, so that unhealthy-looking sores may result. We have seen such in a fatal case become actually gangrenous before death. The patient is sleepless, and becomes anæmic and completely exhausted. Death, however, may not result from actual exhaustion, it may occur in consequence of pyæmia or pericarditis. Among over 534 cases there were five deaths, but one of these died, not from chorea, but from an intercurrent tubercular meningitis. All five cases were in girls; indeed, fatal cases in boys are very rare. Dr. Fagge relates the case of a boy who died in nine days, and another boy of 12 years who died from obstructed breathing due to phlegm, the tongue having been severely bitten.

The following is the history of a fatal case of chorea:

Chorea, Endemialis, Death.—Maggie May R., aged 10 years. Four members of the same family have recently suffered from acute chorea and died due to drops on the back of the house. No history of rheumatism or previous attack of chorea. Patient has been attended at home by Dr. V. Brown. She has had acute chorea at least on two occasions. Admitted February 25, 1911. The choreic movements are uniformly severe, she cannot feed herself; the heart's action is irregular, but there is no fever, there is no evidence of uræmia; urines on her lips and teeth; temperature, 98°-100°; sleeps little. March 2.—Has been taking bromide and chloral, is quieter, and the movements are less; temperature, 98°-98°. March 9.—Still improving, so that hand, sleep better. March 11.—The temperature has gone up to 104° F. this afternoon; the movements are now very violent; chloroform has been given to quiet the excessive movements. First level for the first time at the apex. Nipples in 10 minutes doses seem to ease; chloral appears to answer better. March 13.—Has been taking bromide, chloral, and hyocyamus; is quieter, but takes food with difficulty; temperature, 99°-101°. Extensor surfaces of the arms are very rough and sore from friction; there is swelling of the right parotid. March 15.—Much worse today. (Respiration, Cheyne-Stokes.) Died in the evening.

Post-mortem.—Skin swerving elbows and wrists roughened and abraded, also on back of hands; also over typhoid process of xiphoid and lower end of stern; both men and abraded; hair at back of head very off; knuckles abraded. Much swelling of right

muscle. *Esophagus*.—The adhesions round the right upper lobe dark red, solid behind, and sink to water; inferior edge emphysematous; lower lobe areolar. There are patches of consolidation in the left lung; the back of the upper lobe is engaged. *Heart* (fig. 1) is freely contracted, especially at ventricle. Mitral valves show broad valvulitis, the edges being banded (see fig. 25, which was drawn from this case); other valves healthy. No dilatation or hypertrophy. *Liver*—enlarged, Peyer's patches swollen, slightly attended in places. *Liver* (fig. 26) enlarged and congested. *Spleen* (fig. 27) large and soft. *Alveoli* congested. *Polici*.—Nails on surface fall. *Arteries* moderate spasm and cloudy, except of subcutaneous kind. There is a patch of what appears to be lymph on the coarse surface. In the Symp. Arterio the arterioles are especially spasmic. The brain substance is firm, the capillaries are congested.

Chorea is a chronic disease lasting for many weeks, often many months, but it is usually not equally severe throughout this period. Ten weeks is also stated to be the average; it certainly is often much longer. Relapses are exceedingly common; it is not uncommon for children to have three to five attacks, but the tendency passes off after puberty.

Complications.—In the majority of cases of chorea the heart is in some way or other affected. In some cases chorea apparently supervenes in children who are suffering from chronic heart disease; in a few cases it appears to be brought on by an attack of pericarditis; but in the majority of cases the heart complication comes on during the course of an attack of chorea. One of 152 cases of chorea, nothing abnormal was noted in the heart's action; in 79, in 53 there was irregularity or reduplication of the sounds; in 100, murmurs, mostly heard at the apex more loudly than at the base, were detected. Some of these murmurs were, no doubt, anemic, inasmuch as they were present only at the base; it is seldom, however, possible to say dogmatically that a heart heard during the course of chorea is simply anemic, and it is necessary to have the patient under observation for a long period during convalescence before we are in a position to say if a so-called *harmic* heart is due to organic disease or not. It is well also to remember that endocarditis may occur and yet no heart be produced; thus we have sometimes failed to detect murmurs in cases of chorea, but some months afterwards have noted undoubted organic murmurs. Both mitral and aortic valves may be affected, though the former are far more commonly affected than the latter; while many of those in whom murmurs are heard during chorea have suffered from rheumatism, this is by no means the case with all.

Acute or sub-acute rheumatism was associated with chorea in 26 out of 152 cases, while 20 more, according to these friends' account, suffered from 'rheumatic pains.' Statistics with regard to the association of chorea and rheumatism vary considerably, but this is hardly surprising, inasmuch as we are largely dependent upon the histories given by friends, and their ideas concerning rheumatism are apt to be vague; moreover, the symptoms of rheumatism are often less well-marked in children than in adults, and rheumatic attacks may be easily overlooked, or at least may not be recognised as rheumatic. The association of rheumatism and chorea is understood, and cannot be a mere coincidence; not only do we see children suffering from chorea attacked with rheumatism, and vice versa, but not infrequently we see a sister suffering from chorea and a brother from rheumatism, or attacks of chorea and rheumatism alternating in the same individual. Rheumatic nodules are present in a few cases.

The following case illustrates the association of chorea with (hemianopia).

A Case of Chorea attended by Paralysis and Loss of Speech for eight or ten days, and complicated with Pyæmia, Eczematous and many Fissured Nipples. About after my marriage—Edith M. N., aged 15 years, the daughter of a surgeon, was fairly strong and enjoyed good health till early in June 1886, when it was noticed she had decided decided chorea movements; for three or four weeks previous to this some premonitory symptoms, such as excessive sleepiness, had made their appearance. In the previous September, eight months before the beginning of the illness, she received a severe fright when away from home, and since then had been subject to peculiar nervous attacks. There is a strong rheumatic history in both parents.

During the early weeks of June the chorea movements usually increased, and were most marked in the face and right side of the body. Her speech was affected, and in June 15 she lost the power of speech, a condition which lasted for eight or ten days. About this date she lost control over her limbs; any attempt at voluntary movement resulted the involuntary movements, stronger and more erratic. She was unable to change her position in bed, and, indeed, no one movement was nearly effected by slipping down under the bedclothes and being unable to extricate herself. On the same day several joints became tender, being most marked in the right elbow and wrist.

During the next few days the movements became more violent; all the limbs being tossed about, the head jerked and banged from side to side, and the limbs incessantly convulsed. She was fed with difficulty, on account of the movements of the muscles of mastication and a difficulty of swallowing. Early in July a mutual repugnance to eat was detected, rheumatic pains were constant, and Erysipelas made their appearance. The (hemianopia) grew varied, sometimes the points were tender, in other times there were shooting pains down the legs; the first nodus protuberans was over one of the supra-orbital processes of the convex sinus. These nodules were followed by more when, which made their appearance during the succeeding two or three weeks. At one time there were at least six present, being situated on the scalp, borders of the scapula, along the ribs, borders of the hands and feet. There was one pressed over each supra-orbital protruding an appearance resembling Dr. Chace's illustration in the *Lancet*, May 4, 1886. They varied in size from a pea to a large filbert, and in some places, especially on the back of the head, they presented an almost bossy hardness.

The chorea movements at this time were exceedingly severe, continuing both night and day, the patient claiming very little rest. The tongue and innermost membrane of the cheeks and lips were bitten and troublesome ulcers resulted. The lower jaw was stiffened, apparently from spasm of the muscles, so that the lower incisors could make the upper incisors. There were frequent involuntary movements of the bowels and bladder.

On July 12 a friction sound was heard over the cardiac region, followed by a large effusion into the pericardium, with a weak and rapid pulse. By the end of July the fluid in the pericardium had diminished in quantity and the dyspnoea was less urgent than it had been. The chorea movements were less violent, but a patient of the extent of the fingers and an insensibility of the fingers was noted, so that a ball of cotton wool had to be kept in the palms of the hands to protect the skin from being injured by the nails. Another noteworthy point was the extreme irritation of the jaw. The emaciation and exhaustion had now become extreme.

In August another attack of pericarditis occurred, with effusion, and at the full became absorbed the systolic murmur was a new one before he came home; there was also a thrill and a distant pericardial bruit.

The condition remained much the same during August and the early part of September, at this time she was kindly seen by Dr. W. H. Cheyne of London. On the evening of September 5 the power of speech suddenly returned, and from this time she was able to converse with her friends. Later she suffered from several fresh attacks of rheumatic pains and violent attacks of pain over the pericardial region.

During the latter part of September and during the next two months gradual improvement took place; the movements ceased, the paroxysms of the limbs disappeared, and she was able to walk with help, but the heart evidently became more and more enlarged, and the systolic bruit more marked.

In January signs of cardiac failure set in: there was enlargement of the liver, great anæmia, dyspnoea, and dyspnoea on exertion. There were also frequent attacks of nocturnal neuralgia, the pain being referred to the parasternal region; and there was a sense of constriction round the waist. Early in February oedema of the feet came on, while the attacks of cardiac pain were most distressing, and continued till her death on February 10, the illness having lasted nearly nine months in all.

This case illustrates in a remarkable manner the close association between chorea and the rheumatic state, and the damage which the heart may suffer in the young without the patient suffering from a typical attack of articular inflammation. Apart from the severe chorea from which the patient suffered, there was a continuance of the 'rheumatic state' for several months, during which time there were joint tenderness, shooting pains, acid perspirations, numerous crops of 'fibrous nodules,' patches of erythema, and repeated attacks of peri-endocarditis. It is evident that the latter was chiefly instrumental in bringing about the fatal termination, for it was clear there was not only a damaged mitral valve, but the frequent attacks of pericarditis must have bound the heart tightly round with fibrous adhesions. One of the unusual features in the case was the distressing cardiac neuralgia, the pain over the heart appearing to be intense, and the sense of constriction round the chest being very marked and difficult to relieve. There was doubtless a labouring ill-nourished heart struggling with its load.

Of what prognostic importance were the large crops of fibrous nodules? We may certainly say they pointed to the intensity of the 'rheumatic' state, and the consequent probability of recurrent attacks of peri-endocarditis; it is worthy of note that these nodules were usually situated over prominent parts, and where, in the choreic state of the patient, friction would be most intense. Thus they were present on the back of the head, over the spinous processes, and along the edges of the scapula. In the rheumatic state, as Dr. Cheadle insists, there is a special liability to irritative lesions of the fibrous tissues; this is seen in the nodules—which are caused by a proliferation, and cell-infiltration of the fibrous tissue—and in the endocardial, pericardial, and pleural inflammations. If, as he believes, there is a close relationship between the fibrous nodules and peri-endocarditis, the significance of the occurrence of nodules cannot be overrated.

Perhaps the most interesting features in the case were those connected with the nervous system. For nearly three months the patient did not speak and the only sounds made consisted of a sort of 'grunt.' She was perfectly sensible and rational, and would try to nod or shake her head, but any attempt at speaking, especially when the chorea was at its worst, made the involuntary movements of the face and neck more violent. The cause of the loss of speech was doubtless due to a loss of control over the muscles of the tongue and lips. This was also manifested in the difficulty of masticating food. The power of speech entirely returned, and was retained up to the time of her death.

Another peculiar symptom was the retraction of the jaw, which was well marked, apparently being caused by over-action of the masticatory muscles. In the later stages of the choreic attack, the weakness of the arms and the over-action of the flexors of the fingers were well seen. The hands were tightly clenched, and any attempt to force them open gave pain and brought

on a more convulsive action of the flexors of the fingers. There was also some rigidity of the legs with quivering of the toes. At this period there was much wasting of the muscles, with a certain amount of tenderness on pressure over them.

A **paroxysm** of one kind not infrequently takes place in chorea; such cases have been described as *paralytic chorea*. It consists in weakness rather than paralysis, and not infrequently precedes the other symptoms of chorea. A **peripheral neuritis** in rare cases appears to follow chorea, as it does also rheumatic attacks, the principal phenomena being muscular wasting and pains, sometimes pains such as 'pins and needles,' and in some instances anæsthesia.

In some cases there is sufficient excitement of the brain to merit the name of **maniacal chorea** or **chorea maniacalis**. This condition is rare even in adult subjects. There may be violent delirium and excitement, so that the patient has to be controlled by her attendants, the attacks resembling acute mania. Often these attacks are closely allied to or resemble hysteria. The following case appears to have been one of this kind:

Maniacal Chorea, Myelitis.—The patient was a girl of fourteen years of age; her father and herself had enjoyed a peace and a health before the present attack, which lasted for some time, and for which she was treated in the Derby Infirmary. She was troubled with choreic movements of maximum intensity, but they were readily controlled by herself, and she was perfectly rational. She got worse, the movements being more violent; there was difficulty of speech, she became extremely emotional and at times maniacal. When she was brought in, for instance, when her feet were inside—she would struggle and try to get back into the attendance. Two weeks after admission the knees became stiffened and rigid, and there was immobility of arms and torso. She was so troublesome that she was sent home after about three weeks in hospital.¹ Some time after she was admitted to the Children's Hospital. At this time she had nodos on her lips and nose, her feet much swelled; both knees were swelled and rigid, the hips were swelled and rigid; the passive reflex could not be obtained on account of the extreme rigidity. There were slight choreic movements of the arms and face; she passed her urine and feces into bed. She was extremely emotional, and there was some hyperæsthesia especially about the joints and muscles. She gradually began to improve in her work at home, having more control over the sphincters, and the legs became less rigid and she gained flesh. A fortnight after admission the bedsores had healed, and she was less emotional. In a month she could walk with help, and in three months she was discharged quite well.

In this case there seems to have been aggravated hysteria associated with chorea, though at one time the girl looked very much as if she were suffering from organic brain disease. The emaciation, bedsores, and rigid legs seemed to point to an organic lesion; this was, however, negatived by her complete recovery.

In some rare cases instead of paresis there is muscular spasm, which may persist for some time after the choreic movements have disappeared. The following case illustrates this:

Chorea, Muscular Spasm.—A boy aged 14 years, was admitted to the Children's Hospital suffering from chorea, which was attributed to a slight, but having been a 'glove at a show.' Three weeks had elapsed since the onset of the chorea, and having died during an attack. His attack was a moderate one; but when he was found, there was some paresthesia of his right

¹ These notes were kindly furnished by Dr. W. Benthall, of Derby.

ing. He was discharged in a month's time quite well. He had remained two months later, the choreic movements being partly much confined to the right arm, which was markedly weak; the right knee joint and ankle were rigid, the muscles being in a state of atrophy; there was no pain or tenderness. There was a systolic bruit at the apex. Strength discharged in six weeks; the choreic movements had disappeared but the spasm in the right leg persisted. He had another attack of chorea eighteen months afterwards; before we saw him, the muscular spasm had entirely disappeared.

Hemichorea.—In many cases, as already pointed out, the movements are confined to one side of the body, or at all events they are more marked on one side than the other. Hemichorea is in some instances post-hemiplegic, following some months or more after the hemiplegia, when contractions are present, as in the case of cerebral tumours situated near and involving the internal capsule or pyramidal tracts; choreiform movements may take place on the opposite side. In hemichorea symptomatic of brain disease the movements are vigorous and grotesque, the fingers, hands, feet, and extremities being relaxed and jerked about. In one of our cases is a boy of five years of age, who had a cheesy tumour in the right optic thalamus, at first sight the child appeared to be affected with the ordinary form of chorea. His left arm was in constant movement, the result of short, irregular, jerky contractions of the muscles of the forearm and arm, following one another with great rapidity, and closely resembling those seen in a severe case of chorea. When the boy was at rest the arm was quiet, only a sort of fumbling movement of his hand being noticed, but on asking him to sit up or give his hand, vigorous, almost violent, movements began again. Some of the movements were produced by all the muscles of the arm, yet some of the muscles acted more continuously and powerfully than others, so that the arm tended to be held to the side and more or less behind, while the forearm was protracted and the wrist flexed, the fingers being in continual movement. This condition of hemichorea differs from 'athetosis' or 'mild' spasm already described (p. 477).

Morbid Anatomy.—Various minute changes have been described in the brain in fatal cases of chorea, but it is quite certain that no constant and invariable lesion has been discovered. Endoarteritis and thrombosis of the minute vessels of the cortex and basal ganglia have been described; minute spots of softening, changes in the nerve cells, and enlarged perivascular spaces have also been found. We cannot say that any of these observations throw any light on the morbid anatomy of the disease, especially when we remember that on various occasions competent observers have found nothing of importance in their examination of the brain and spinal cord in fatal cases. Many of the changes described are no doubt secondary, the result of hyperæmia of the nervous centres.

The frequent association of chorea with rheumatism and endocarditis suggested to Kirkes the idea that chorea was the result of minute embolism of the brain by fragments of fibrin washed off the mitral valves. This hypothesis, however, is quite inadequate to explain the phenomena presented by the disease; thus chorea has followed within a few hours of a sudden fight, and moreover fatal cases have been recorded (though rarely) in which no endocarditis has been found. Endocarditis will not explain those cases of "reflex chorea" in which the exciting cause is an acute otitis, or when chorea

follows some injury or abnormality pregnancy; we find that pericarditis and perhaps endocarditis, act as exciting causes operating through the nervous system, just in the same way as some gastric-intestinal irritation may be the exciting cause of convulsions in infants.

In considering the pathology of chorea we must take into account the associations of chorea, though it cannot be said they help us much in coming to a conclusion. Chorea is associated, on the one hand, with rheumatism and endocarditis, and on the other with hysteria and mania; the former association would suggest a blood-change, the latter simply a functional disturbance of the nervous system. Pathologists in formulating their theories have leaned either to the one or to the other. Sometimes chorea has been explained as secondary to endocarditis, as a result of capillary embolism, or as the result of a 'rheumatic' condition of blood, in which some chemical poison has been present in the blood which has a specific action on the nervous system. At other times chorea has been looked upon as an emotional disease, and, like hysteria, a purely functional disease, or, as it has been termed, an 'insanity of the muscles' or motor region of the brain, just as mania or other forms of insanity affect the seat of the mind.

There has been also much difference of opinion with regard to the seat of the disease; it has been placed in the spinal cord, basal ganglia, and cortex of the brain. The fact that the face is usually affected, and that many of the choreic movements are frequently one-sided, would almost certainly point to the seat of the disease being within the cranium. The results of recent researches in physiology has been to deprive the corpus striatum of its alleged function as an organiser or co-ordinator of motor actions, and to assert that it has little or nothing to do with the discharges of motor force. On the other hand, there is strong reason to believe that the choreic movements are the result of irregular discharges from the motor region of the cortex; for the time being the will or the inhibitory influence of the frontal regions is in abeyance, and irregular purposeless discharges are given out from the cells in the motor region of the cortex. There is much reason to believe that the functions of the cortex are impaired in chorea, as shown not only by the spasmodic movements, but also by the paresis which sometimes occurs, and the mental dullness and emotional disturbance so often present. It can easily be understood that if there is impaired function of the sensorium, a sudden fright, or an impression at some distant part, may start the irregular discharges from the cortex, which it may soon be beyond the power of the will to control.

With regard to the cardiac complications found in fatal cases we cannot do better than quote Dr. Stanger, who says as follows: 'Vegetations, new or old, on the auricular surface of the mitral valves, with or without similar deposits on the aortic valves and sometimes with pericarditis, are met with in the great majority of cases dying of, or with, or shortly after, chorea. This condition, however, does not, as a rule, contribute directly to the fatal issue; it is found equally among those that die with and those that die of chorea, and in some of the most marked and typical cases of fatal chorea too valves of the heart have been found absolutely healthy.'

Diagnosis.—This is not usually difficult, though it must always be borne in mind that the choreic movements present may be symptomatic of some

various brain lesions, or of some distinct disturbing influence, such as periodicals. We have seen on one or two occasions, in girls about puberty, choreic movements followed by emotional disturbance and paroxysms of limbs, agitated not terminally to hysteria, where the onset of optic neuritis and amblyopia has made it clear that the case was really one of cerebral tumour. We have seen also the onset of chorea in a girl of four years followed in a week by pericarditis and death in a few days.

Any brain lesion which presses upon the pyramidal tract may give rise to movements similar to chorea: we have several times seen this in choreic twitches of the optic thalamus which compressed the internal capsule; in such cases a 'hemichorea' is produced (see p. 491). It must be borne in mind that in true chorea, if at all intense, the movements are general, though perhaps worse on one side than on the other, but they are never confined to one side, as in the case of cerebral tumour.

In some of the special varieties of the disease the diagnosis may be difficult; thus in the associated (p. 492), where there was contraction of the limbs and bedsores, one might readily assume that chronic meningitis or other cerebral lesion was present. In a case under my care, where tubercular meningitis supervened in the course of chorea, the diagnosis was uncertain for a few days. The presence of optic neuritis would strongly point to organic disease, though, as already stated, Gowers has observed optic neuritis in a case of chorea. In cases of paralytic chorea the chief symptom may be simply paresis of one arm; but usually a slight examination will detect slight clonic spasm, either in the affected arm or elsewhere.

Prognosis.—Recovery follows in the vast majority of instances. The principal danger is from some heart complication, as pericarditis, and from exhaustion in consequence of the violence of the movements, want of sleep, and nourishment. The more severe the case, the longer will be its duration. Maniacal and hysterical choreic cases are usually very chronic.

Treatment.—The most important element in the treatment of chorea is rest. It is necessary to secure for a patient suffering from chorea complete rest for the body, and complete absence of excitement of all kinds. In all but the mild cases it is well to begin the treatment by keeping the patient for a few days or a week in bed completely at rest. We must bear in mind that voluntary movements of all kinds (in severe cases at least) make the involuntary movements more marked and more completely beyond the control of the will. On the other hand, the movements cease during sleep, and the more quiet a patient can be kept, the better chance there is of a better nutrition of the body and the nervous centres. Any excitement or mental effort is certain also to make matters worse, so that all forms of mental work must be avoided, while the surroundings of the patient must be made as agreeable as possible. When the movements are severe, so that the patient cannot sleep, some narcotic must be prescribed, and of remedies of this class chloral is probably the best, but it must be given in full doses to be of use. Ten or fifteen grains may be given, and repeated in four hours if the restlessness continues. Bromide of potassium may be combined with the chloral, though most agree that chloral is more useful than the bromide. Morphia seems at times to add to the contentment present, though in some cases

it acts better than chloral. In the case recorded on p. 490 (girl aged nine years), chloral and bromide merely failed. Nephrothe in solution was given sleep; later in the disease as much as 30 minims, and on one occasion 70 minims, were given in one night. This was, of course, only after a tolerance of the drug had been established. Inhalations of chloroform are often useful to get the patient off to sleep. Great care must be taken to prevent the patient from injuring herself by crawling out of bed, and it may be necessary to protect the limbs by wrapping them up in cotton wool or to surround them with some soft material; or padded boards may be placed on each side of the bed, or a mattress may be placed on the floor. The patient should be given a fair amount of liquid nourishment, and also stimulants. Frequent spongings are of great value in getting the skin to act and raising the patient.

Even in the less severe cases of chorea it is well to confine the patient to bed for a week or two in the early stages: the movements are always less when the child is at rest in bed, and these means are almost certain to shorten the duration of the attack. When improvement occurs the patient may be allowed to get up for a few hours a day and to be taken out into the fresh air, but too much exercise should be prevented.

The drug which is most used at the present time is *arsenic*; sulphate or oxide of zinc, camaleis indica, iron, Calabar bean, and cocaine have also been used. We confess to some scepticism with regard to the value of arsenic in chorea, and feel sure they occupy only a subsidiary place in treatment. Arsenic is certainly of use in the dyspeptic conditions which so often accompany chorea, but it requires to be given in increasing doses as the stomach becomes more and more accustomed to it. Two or three-minim doses may be given three times a day at first, and increased at the rate of an extra minim every week till six or seven minims are given. It is better not to continue the administration for too long together, as a transient darkening of the skin is apt to take place. The administration may be omitted for a week or two, and then recommenced. In the latter stages iron may be useful, given in combination with arsenic.

Great care should be taken to regulate the breath; constipation is the rule, and this may be overcome by small doses of extract of aloe or some other of *cassia sagrada*.

In chronic cases a change of scene, such as residence at the seaside, is often suggested by the friends, but in our experience this change often makes the movements worse and prolongs the attack, in consequence of the excitement attending the change and the patient attempting to do more than her strength permits. A change to the seaside should be deferred till the movements have nearly ceased and can be controlled entirely by the will. The same may be said of gymnastic exercises and hygienic movements; they are of the greatest use when the movements tend to become habitual, while the health of the patient is good; they are certainly not desirable in the earlier stages. Massage has been employed with good result by Goodhart and Phillips, and in some of our own and our colleagues' cases the result has been satisfactory.

Although the course of chorea mental treatment is of the greatest importance. Chorea in many cases is closely allied to hysteria, and a firm but

usually demeanour towards the patient is called for; and she should be encouraged to control the manifestations as much as possible by an effort of will. In all severe cases a nurse should be provided, as the patient's mother within the last person who should have charge of her.

In all stages of the attack a nourishing, easily digested diet is necessary; in severe cases it is necessary to feed the patient; in such patients fluid food only can be administered.

Epilepsy

Convulsive seizures of various degrees of severity are common during childhood and youth, and when they are idiopathic—that is, without assignable cause, no cerebral or other lesion being discoverable—the term 'epileptic' is applied to them. It is difficult to say in what proportion of cases children who suffer from convulsions during infancy become confirmed epileptics; certainly the majority of those who suffer from infantile convulsions lose this tendency to convulsive attacks as they grow older. In only about 12 per cent. of cases of chronic epilepsy is there a history of the fits commencing during the first three years of life, and in a smaller percentage (5) during the first year. (Gowers.) According to statistics collected by Gowers, in one-fourth of the total number the attacks begin before the age of ten years, and nearly one-half between the ages of ten and twenty years. These statistics show that there is always the possibility that children or infants who suffer from reflex convulsions may become epileptics; yet there is a strong probability, if the child does not suffer from any cerebral defect, or has no hereditary tendency in the direction of epilepsy, that he will not grow up an epileptic. Hereditary influences certainly predispose; a family history of epilepsy or insanity is obtained in about one-third of the cases of epilepsy, in others it may be found that they come of nervous families in which members have suffered from chorea or hysteria.

Of the exciting causes there is little to be said. The first fit may be described by the friends as being due to a 'sunstroke,' or a 'blow on the head,' or a 'fright'; but it is unsafe to place much reliance on such statements, as they may be merely coincidences, and certainly are not sufficient in themselves to produce epilepsy. In the large majority of cases, it must be confessed, no immediate cause can be discovered. Epilepsy sometimes commences after scarlet fever and other systemic diseases, but beyond the fact that these fevers leave a certain amount of weakness behind, and so may predispose, there is nothing to suggest that they act as effectual causes. The approach of puberty is a time when the nervous system is in an excitable state, especially in girls, and epileptic fits are very apt to commence at this period, notably in cases where menstruation does not commence at the usual period, but is delayed by any cause. Constipated bowels and a sluggish condition of liver certainly act as predisposing causes.

Symptoms.—Two forms of attack are usually described: the minor form, or *petit mal*, and the major form, or *grand mal*; but these two forms inevitably pass into one another, and there is no marked line of demarcation between them.

The precursory symptoms differ very much. Frequently the first fit and the succeeding fits come in the midst of perfect health, and neither the

patient nor his friends are aware that a fit is imminent. On the other hand, the child may be unusually irritable, easily put out, and nothing pleases it; it may be feverish, dull, and stupid. In some cases the fit is preceded by some warning or aura, by which the patient becomes aware, by past experience, that an attack is at hand. These auras are more common in adults than in children, or in any rare adults are better able to describe their feelings and have a larger experience of fits to fall back upon. The auras are very diverse in character: they may be sensations referred to an arm or leg, or to the throat; these may be headache, vertigo, or dimness.

Small fits.—These minor attacks are very slight in character and are often not admitted to be epileptic by the friends, who usually connect them with the more severe and decided form of seizure. They are often spoken of as 'faints' or 'attacks.' There may be no real convulsion or tonic spasm; the child may stumble when walking from a momentary impairment of consciousness, a peculiar look crosses its face, and for a moment it is dazed and forgets what has happened. Sometimes the face becomes pallid for a moment, and there is a slight convulsive spasm of the facial or other muscles. The urine is rarely passed in these seizures, nor is there any cry. Sometimes the attack is succeeded by drowsiness or sleep. In older children the behaviour may be very peculiar: after one of these minor seizures a wild mania may seize the patient, he becomes mischievous or strikes other children without provocation, or behaves in an hysterical manner.

Grand fits.—The seizure may begin with a sharp cry or scream, as of sudden fright; in many cases this cry is absent, the patient falling precipitately on to the ground in an unconscious state. The face is pallid and tonic spasms of the muscles begin. Sometimes these are one-sided in distribution: the muscles of one side of the face, neck, arm, and leg of the same side are thrown into contraction, the head is usually rotated to the affected side. In other cases the spasms are general. The legs are usually extended and stiff, the elbows partially bent, the wrists flexed, and the fingers in a position of immemorial spasm. (Gowers.) The respiratory muscles jerk in the general tonic spasm, and, as the respiratory muscles are more powerful than the expiratory, the breath is drawn in and held, so that the face becomes congested and the lips blue. There is usually spasmodic contraction of the muscles of the jaw, so that the tongue is bitten and held between the teeth; frothy, perhaps blood-stained, saliva runs from the patient's mouth. Death may take place from asphyxia during this stage. Usually, however, after the stage of tonic spasm has lasted from a few to thirty seconds, the continued spasm of the muscles relaxes, and clonic or intermittent short contractions succeed. The muscles of the face twitch, so that the patient appears as if he were making grimaces; the limbs 'work' alternately flexing and extending—sometimes so violently that the head and legs are hinged about and become lacerated and injured. In other cases the clonic spasm is not so vigorous, there being only short, sharp, irregular contractions. The urine and sometimes the feces are passed. The period of the clonic spasm is variable: it may last many minutes, or even hours; the patient gradually recovers consciousness, and has no recollection of what has passed. He probably is dazed and sleepy, goes off to sleep, and wakes up tired and sore.

The fits vary much in intensity ; often the stage of tonic spasm is short and not well marked, and the whole duration of the fit is not more than half a minute. In some cases, especially after severe attacks, a temporary paralysis, mostly hemiplegic, is left. We are inclined to attribute this to a meningeal hæmorrhage which has taken place during the respiratory spasm.

Hysterical Fits.—Some minor attacks closely resemble hysteria in that the spasmodic movements are of a purposeful character, as if directed by the will, and, moreover, the child appears to be conscious or semi-conscious during the fit. This form of seizure is common both in boys and girls. The phenomena which take place are exceedingly various ; the child may commence by barking like a dog, or meowing like a cat, or may attempt to bite its attendants ; the head may be banged about and the legs and arms thrown wildly about, as if the child were directing the movements. The patient may stiffen out and arch his back as in opisthotonus. Sometimes the actions are still more co-ordinated. Thus in a girl of seven years, in hospital, when an attack came on she would jump up in bed, turn round once or twice, sit down again and arrange the bedclothes, smoothing them usefully down, and yet be unconscious during the fit, and have no remembrance of it afterwards. A sharp word or the prick of a pin will often arrest these fits. That some of these cases are closely related to epilepsy is shown by the fact that they may alternate with true epileptic fits, or they may supervene at puberty in children who have suffered from chronic epilepsy.

Post-hemiplegic Epilepsy.—Children who suffer from hemiplegia which dates from birth or within a year or two of birth are very apt to suffer from epileptiform attacks. Convulsions are very apt to attend the onset of the hemiplegia ; the child may continue to have fits, and be subject to them for the rest of its life. In other cases a period of months or years may elapse between the onset of the hemiplegia and the commencement of the epileptic fits. It is often about puberty that they recur. As a rule, the convulsions affect the paralysed side only, but in severe cases the convulsions may be general. An aura or warning of the approaching fit is more common in post-hemiplegic epilepsy than in idiopathic epilepsy. In these cases it is common for mental backwardness to exist (see case, p. 474).

Cause.—As already stated, the epileptic fits may date from infancy, the child having suffered in the early months or years of its life from convulsions, and these have been succeeded by chronic epilepsy. More often the child has been free from convulsive seizures during infancy and early childhood, and it is only during the second dentition or as puberty is approached that it has begun to suffer from fits. The health prior to the commencement of the fits may have been excellent, there may be no history of epilepsy in the family, and it may be quite impossible to explain the onset of epileptic fits. At first the friends are loth to believe the fits to be epileptic, and attribute them to rapid growth, dentition, weakness, or some injury. In other cases the health may have been indifferent or the temperament peculiar, the child having been of a strange disposition, nervous, easily frightened, moose, or backward in mental development, or may have shown signs of idiosyncrasy, and then, as puberty approaches, commences with epileptic fits. The health of the child after the commencement of the fits varies according to their frequency and severity. In the milder forms the children may enjoy

the best of health, may be merry, roving children, able to take their part in rough school games, and be of average or more than ordinary quickness and intelligence. In other cases, especially when the fits occur frequently, the health suffers, the patient becomes sallow and anæmic, his digestion and appetite are poor, and the liver and bowels sluggish. The memory is apt to fail more or less, and in the worst cases a condition allied to dementia may supervene. The intervals between the fits differ considerably, not only in different patients, but in the same individual; sometimes many months or even years will pass without a fit, at other times the fits follow one another at intervals of a few minutes, so that the patient is as soon out of one fit than he is into another. To this latter condition the term 'status epilepticus' has been applied. In the *petit mal* the fits usually occur oftener than in the more severe attacks. Fits may occur at any time in the twenty-four hours, at night or by day, but there seems to be a special tendency for them to recur in the early morning when the patient is getting up.

Prognosis.—The prognosis is bad in those who have suffered from fits from infancy, and who are mentally deficient or in whom some mental change has taken place. The chance of the entire cessation of the fits is a poor one in those who have fits frequently. The less frequent the fits, the greater is the probability that they may cease altogether. Even in those who have only suffered from fits at long intervals a cautious prognosis must be given, as those who have so suffered are never safe, and a recurrence may at any time take place. The danger to life is least in the minor attacks, but as time goes on the major attacks may supervene. There is always the possibility that the fits may cease when the epoch of puberty is passed, and in the case of girls when menstruation is thoroughly established. It must always be borne in mind that epileptics may at any time meet with a sudden death from injuries received during a fit: they may fall into the fire, or into water, or they may be suffocated in bed at night. Less often death takes place in the fit from asphyxia, due to prolonged spasm of the glottis and respiratory muscles.

Diagnosis.—In some cases of *petit mal* the attack may be so slight that doubt may exist whether the fits are really epileptic or not; but all recurring 'furies' or attacks of gibbering must be looked upon with great suspicion, and if there is a loss of consciousness, however short, they are almost certainly epileptic. Difficulty may often arise in distinguishing hysterical attacks from true epilepsy, especially the attacks described as hysteroid. It may be simply a matter of opinion whether some of these attacks are best classed with epilepsy or hysteria; in any given case careful inquiry must be made for typical epileptic fits, which sometimes occur immediately before the hysteroid fits. The diagnosis is usually easy between typical epileptic and typical hysterical fits; it is often very uncertain in atypical ones. Loss of consciousness, biting the tongue, or urine followed by clonic spasms, if present, are decisive in favour of epilepsy. There may often be considerable difficulty in distinguishing between reflex convulsions and epileptic fits. Under three years of age, if there are the signs of rickets, the probability is strongly in favour of their being reflex. After this age reflex convulsions may occur at the commencement of some systemic disease, or possibly as the result of cutting the primary teeth, or from worms; but the

dances are immensely in favour of epilepsy if they are on the type of those in idiopathic epilepsy; in all cases where the attacks are epileptiform in character, in which there is loss of consciousness, spasm followed by stupor, even though the child is cutting one of the permanent teeth, or has worms, we should be inclined to believe they are really epileptic. Parents naturally like to believe that the fits are due to dentition, to rapid growth, to a disordered liver or stomach, especially in those cases where there are no hereditary tendencies present; but we cannot accept these as anything more than exciting causes, and in all such cases there is only too much reason to fear that there may be a recurrence of the attacks. Convulsions may occur as the mark of brain disease, recent as well as old. A tumour or syphilis may be present in this case: there may be some marked aura, especially visual or auditory; the convulsions will be mostly one-sided; moreover, there is headache, giddiness, vomiting, paralysis, and optic neuritis.

Treatment.—A child subject to epileptic fits should be placed under the most favourable conditions possible, and should be most carefully guarded from excitement, over-fatigue, and over-feeding. A healthy country life, with plenty of outdoor exercise and sufficient employment for the mind, must be enjoyed. A moderate amount of brain work may be allowed, but no forcing of any kind should be permitted. It is well to allow no work and not much exercise before breakfast, as at this time there appears to be an especial liability to fits. The diet should be simple and unstimulating; in some cases coming under our notice children have done better when butter's milk has been excluded from their diet or only taken sparingly. How useful a regular life is, is seen by the improvement which nearly always takes place on the child's admission to hospital. It is needless to say that all children subject to fits should be carefully watched; a public or large school is certainly not the place for them, as they require more individual attention than is possible under such conditions. There is always the possibility that they may fall into the fire, or into water, or be suffocated whilst by a fit occurring during the night. The state of the bowels should be most carefully attended to, as there can be no question that constipated bowels predispose to the attacks. Effervescent drinks of potash, magnesia, or calcium, with occasional small doses of calomel, are useful. Of all medicines which check the tendency to fits the bromides take first place. Bromide of potassium or sodium may be given in doses of 10 to 20 grains a day, according to age and to the frequency of the fits. The saline taste is readily covered by well drinking with water, and adding syrup of orange peel, aromatic sp. of minerals, or liq. ext. of liquorice. (F. 29.)

Sometimes a laxative may be combined with the bromide to counteract its constipating action; sulphate of magnesia, tincture or infusion of rhubarb, or 'cascara cordal' or 'elene' may be used, but, as a laxative can be given as required, it is usually unnecessary to combine one with the bromide. The bromide should be administered for a month at least after the fits, and then may be reduced in quantity; but it will be well to continue the use of bromide in gradually smaller doses for six months at least after the last fit; it may be combined with digitalis or tonics such as cinchona, iron, or nuxvomica.

Large doses of bromide give rise to a lethargic heavy condition in the

patient; there may be slow drawing speech, and a slow circulation. Asepsis apt to make its appearance after a few doses of bromide in some patients.

There is no other drug that at all approaches bromide in value for epilepsy. Nitrate of sodium, belladonna, zinc oxide or lactate ($\frac{1}{2}$ to 5 grs.), borax (5 to 10 grs.), nitro-glycerine ($\frac{1}{2}$ to 1 grs. of a grain), and strychnine have all been used with more or less advantage when bromide fails.

The question of surgical interference must depend upon the diagnosis. In idiopathic epilepsy trephining, or ligature of the carotids is hardly justifiable. If there is reason to believe that a tumour in the cortex exists, an operation may be considered (see p. 485).

Infantile Convulsions. Eclampsia.—Infancy predisposes to those irregular nerve discharges which go by the name of 'convulsions' or eclampsia. The undeveloped state of the cortical centres during infancy, and the consequent absence or imperfection of the controlling or inhibitory influences exercised by these centres in later life, allow the 'lower grade' centres to discharge their stored nervous force, when stimulated, in a way which does not occur in later years. The reflex actions exhibited by the headless frog are more easily provoked and more vigorous than the reflex actions exhibited by a frog with the brain intact; the higher centres appearing to exercise a controlling influence.

While infancy is the time of life in which convulsions are most easily provoked, yet healthy infants do not become convulsed unless the stimulus is strong; it is the delicate ones who are most likely to suffer, and especially those who have inherited neurotic tendencies. That hereditary influences play an important part there can hardly be a doubt, the infants of those who have suffered from epilepsy or who are of a highly nervous disposition certainly more often suffer from reflex convulsions than do the children of strong, healthy parents. The commonest *predisposing* cause, however, is ticks, though in what way it acts is uncertain; yet it is certain that all the tissues in ticks are badly nourished and built up, and the nervous system is no exception to this: the nerve centres appear to be in a condition of unstable equilibrium, and are apt to discharge their nervous force in a purposeless and irregular manner. In the large majority of children who suffer from convulsions between the ages of six months and three years the signs of ticks are present.

An atonic condition, great exhaustion from any cause, as well as hereditary tendencies, predispose to convulsions during the whole period of childhood, but more especially during the first few months of life.

The *exciting* causes of convulsions are mostly *reflex*: the irritation takes place at some distant part, the stimulus passes up to the nerve centre along some afferent nerve, giving rise to a discharge from a nerve centre or centres, the impulse travelling along the efferent nerves to the muscles.

Reflex convulsions may be said to be disorderly physiological reflex acts. In a normal reflex act the nervous mechanism is properly controlled and a useful movement takes place: in a convulsion there is an irregular and wasteful discharge of nerve force which fulfils no useful end. An ordinary movement consists almost entirely of reflex acts of the simplest character, the nerve centres in action being of the 'lower grade' group, situated in the spinal cord, medulla, and pons: such are the acts of swallowing, sucking,

trying, breathing; in each case there is some form of irritation, or a stimulus acting on the nerve centre and transmitted to it by an afferent nerve, and an impulse is sent along an efferent nerve to a muscle or group of muscles, and a definite, perhaps complex, act is performed. In morbid states of the nerve centres an afferent impulse calls forth a series of irregular and muscular movements, mostly in the form of clonic spasms, which may be limited to one group of muscles, or may implicate almost all the voluntary muscles in the body. Thus the presence of indigestible food in the stomach or bowels gives rise to acute pain or griping, and acts as a stimulus over a wide area, and some distant nerve centres, or perhaps many nerve centres, are thrown into activity. As a consequence of this the facial muscles may twitch, the legs be drawn up, the eyes roll about, the fingers be clenched; there may be spasm of the respiratory muscles, and all the muscles of the extremities may be thrown into clonic spasm, or the infant suffers from whooping cough, and the spasm of the glottis passes into a general convulsion. Possibly the respiratory muscles only may be involved, and spasm of the glottis and of the respiratory muscles may result. Dyspepsia or the presence of indigestible food is a fertile source of infantile convulsions in the newly born; newly born infants when fed on artificial food frequently suffer from convulsions, which disappear at once when a wet-nurse is obtained. In making post-mortem on infants and young children who have died in convulsions it is no uncommon thing to find an overloaded stomach, and possibly pieces of meat and other indigestible food in the stomach.

Dentition is another cause; the pressure of the advancing tooth upon the gum, or the tension of the tooth in its socket, may, through the branches of the fifth nerve, produce general convulsions. Bronchitis or pneumonia may be the exciting cause, though the latter sometimes produces convulsions in consequence of the high fever that is present.

The exciting cause of the convulsions may act directly on the centres themselves. Thus the onset of meningitis or any part of its course may be marked by convulsions; an infant has a series of convulsions which are perhaps more or less one-sided, and when they cease it is noticed to be hemiplegic, due, as we have already explained, to cerebral hæmorrhage (see Cerebral Hæmorrhage). The acute stage of infantile paralysis may be attended with convulsions. Convulsions may be caused by chronic brain disease. A poisoned condition of blood may be the exciting cause; thus a temperature of 104° or 105° is exceedingly likely to be accompanied by convulsions, the convulsions ceasing when the temperature falls, and being perhaps repeated when it rises again. Heat-convulsions are exceedingly apt to be fatal. A hyperæmic condition of blood excites convulsions, as seen in infants born in a condition of asphyxia. The onset of some zymotic disease, as scarlet fever, or measles, is sometimes marked by convulsions. The commencement of influenza may be marked by convulsions.

Symptoms.—The convulsive attacks vary greatly in their severity, and in the extent of the muscles involved. They may simply be slight jerky movements of the head and neck, or a limb, or there may be slight twitchings of the muscles of the mouth or eyelids. The fingers may jerk and the thumb turn in, the toes become flexed, movements to which the name of carpo-pedal contractions has been applied. Such slight convulsions are often spoken of

by nurses and parents as 'inward fits,' they are most common in young babies with dyspepsia, or those who are suffering from distended bowels.

A typical convulsion closely resembles an epileptic fit, but the stage of tonic spasm is usually shorter, while the clonic spasms or muscular twitches are more prolonged and vigorous.

The commencement of a fit is frequently marked by spasm of the glottis, so that the nurse thinks for the moment the infant is choking; at other times the rolling upwards of the eyeballs and twitchings of the facial muscles first call attention to the child. The face becomes pallid, the eyes are turned up so as to show 'the whites,' the limbs are extended and stiffened, the hands are clenched, the neck and back are arched, the jaw claps spasmodically; in a few moments the lips and face become of a bluish tinge from the respiratory spasm; the tonic spasm quickly passes into clonic, the hands, feet, and face 'work' for a few seconds or more, and the child becomes quiescent and the fit is over. The child becomes unconscious during the fit, and may remain dead for a few minutes to half an hour after.

The fits may be severe, much of the type of a major epileptic fit, the tongue being held tightly between the gums or injured by the teeth, the child frothing at the mouth and becoming cyanosed, and remaining comatose or drowsy for some time. On the other hand, the convulsions may be partial only; one side may be affected, the leg, arm, and side of the face twitching, or the laryngeal muscles or respiratory muscles alone may suffer. The frequency with which fits occur differs very much; a child may have a single one, and it may never be repeated; or they may occur daily, or there may be a constant succession of fits for twenty-four or forty-eight hours, the child never becoming conscious.

Some of the most severe convulsions we have ever witnessed have been in connection with whooping cough. The child begins to cough and belch, with a general spasm of the respiratory muscles takes place, with spasm perhaps of the muscles of the limbs. The child becomes dark or pallid, and appears to be dead. Perhaps by the aid of artificial respiration it comes round, but such attacks are, we need not say, exceedingly fatal.

Death may take place in the fit from spasm of the glottis. In other cases death seems to be caused in some way through the nervous system, as after death no evidence of asphyxia can be found.

Convulsions in older children are indistinguishable from epileptic fits, and doubtless many of such cases for which no cause is found are really epileptic, or at any rate showing a tendency in that direction.

Convulsions may be associated with idiocy or some mental defect, and it is not always easy to say to what extent the convulsions depend upon the presence of some cerebral lesion or malformation, or whether the mental defect is produced by the frequently recurring fits. It is not uncommon to see children of a few months to a year old who are frequently convulsed, and who are evidently idiots, not able to sit up or hold anything in their hands, and not recognizing their friends. In these cases the prognosis, as far as the mental development is concerned, is grave, though the fits often become less frequent or cease as the infant develops.

Prognosis.—This must always be uncertain, and naturally depends upon the

among causes. The first fit may prove fatal through spasm of the glottis ; on the other hand, it is common to get a history of children who as infants were constantly convulsed and yet have grown into comparatively strong children. Naturally much must depend upon what the exciting cause of the fit is ; if it suggest contracting meningitis the prognosis is necessarily bad ; if there is hyperpyrexia and contracting pneumonia it is very grave. Convulsions following on some exhausting disease, as diarrhoea, are mostly fatal. Convulsions associated with laryngismus are always serious, and the prognosis must be very guarded. In those cases where the fits in young infants are frequently repeated it must be borne in mind that they may prove to be epileptic or associated with mental deficiency, and a guarded prognosis must be given. If there is reason to believe that the convulsions are due to dyspepsia or are symptomatic of sickness, the prognosis as far as the cerebral development of the child is good, but there is always the risk of its dying in a fit.

Diagnosis.—The exciting cause of the convulsions may be difficult or impossible to determine. Convulsions in infants shortly after birth may be due to a hyperæmic state of the blood resulting from congenital heart disease or anæmia, or to a meningeal hæmorrhage, which has taken place during birth. If these can be excluded there is a strong probability that the fits are due to some digestive disturbance, especially if the infant is being artificially nursed. In infants over six months of age, with the symptoms of colic, the fits are in all probability reflex and due to some alimentary mischief such as distention or griping in order to expel undigested curd ; but the possibility of their being due to contracting meningitis or to the presence of tubercles in the brain must always be borne in mind, even in the case of fat healthy looking infants. Vomiting, irregularity or hesitation of the pulse, or an unnatural softness of the abdomen would suggest meningitis. The possibility of the convulsions in infants being followed by a hemiplegia or a paralysis of one or more limbs must not be forgotten. In convulsions in young children the chest should be carefully examined and the temperature taken, and the skin inspected to ascertain the presence or absence of a rash. In frequently recurring fits there is a possibility that the child may grow up mentally deficient, and a careful inquiry should be made as to the child's intelligence.

The fact that infants when suffer from one-sided convulsions, or that the convulsion begins on one side, must not be taken to indicate that there is brain disease of the opposite side, inasmuch as reflex convulsions due to intestinal irritation may be one-sided in the first instance.

Herbid Anatomy.—Convulsions *per se* leave no trace in the dead body, though usually there are the signs of death from asphyxia, the latter being most marked in those dying suddenly in strong health. The veins on the surface of the brain are full of dark blood, there are petechiæ or larger hæmorrhages, and the brain may be unusually full of blood and wet from excess of cerebro-spinal fluid on the surface and in the lateral ventricles, but these conditions are due to death taking place through stasis of blood in the lungs and a consequent engorgement of the general venous system. The *post mortem* continuation of the state of the cerebral vessels gives us no clue to their condition, whether of engorgement or anæmia, during the fit itself, except

such as are produced by venous obstruction. In many cases the autopsy throws no light on either: on the cause of the fit or the condition which accompanied the fit. In others the appearances of commencing bronchitis or pneumonia or acute intestinal catarrh may be found. Difficulties arise, however, likely to be met with at the *post-mortem* in distinguishing between early pneumonia and the sodden and oedematous lung; often present when is due to the manner of death—namely, asphyxia from obstruction to the entrance of air into the larynx.

In making an examination for medico-legal inquiries as to the cause of death, whether from a convulsion or from some other cause, great caution must be exercised in coming to a conclusion, especially in infants. An infant may have been 'suffocated' (i.e. suffocated) beneath the bed-clothes in consequence of the mother going to sleep with the infant in the breast, the mother perhaps alleging that the infant had died in a fit. In both cases the after-death appearances may perhaps be much alike—namely, those of death from asphyxia. In many cases, however, a distinction may be made between a rapidly produced asphyxia, as in death from a fit, and a more slowly produced asphyxia, as in slow suffocation beneath the bed-clothes: in the former the lungs are simply gorged with dark fluid blood, in the latter case the lungs are sodden and oedematous, containing a large amount of frothy fluid. In any case where the tongue is held between the teeth and has been injured, and there are signs of rickets, the lungs gorged with dark fluid, and the vein on the surface of the brain overfull, there is a strong probability that the child has died in a fit. It must not, however, be too hastily assumed that a convulsion has not been the cause of death, because the typical signs of asphyxia are not present: death appears to take place in some cases probably through the nervous system, before asphyxia takes place.

Treatment.—The treatment of convulsions must necessarily be chiefly directed to removing the cause. During the convulsion itself, if there is a high temperature (104°-105°), no time should be lost in placing the infant or child in a tepid bath and pouring cold water over the child and into the bath in order to lower the temperature, which is probably exciting the convulsions, and it may be also necessary to give antifebrile or quinine. In infant convulsions in a robust child, especially if there is colic or abdominal disturbance, a warm bath, or a mustard bath so as to reddens the skin, is likely to prove of service, or the child's socks may be wrung out of mustard and water and placed on the feet, or hot flannels may be placed on the abdomen. If there is reason to suppose the convulsions are due to cerebral disease, or the convulsions come on at the end of an exhausting illness, the warm bath is not likely to be of any service and may be injurious. If the child has taken any indigestible food, which is lying in the stomach or in the bowels, an emetic or one or two grains of calomel should be administered according to the effect desired. If the gums are swollen and tender, as in scurvy, or simply scurvy them, will often do good. If there is coma, it may be well to puncture the membrane.

The inhalation of a few drops of chloroform or spirit of amygd. will usually check the violence of the convulsive spasms, and should certainly be tried if the convulsions last any time or are violent. Of medicines which diminish the irritability of the nervous centres, the bromides, chloral,

and belladonna hold the first place. Bromide of potassium or sodium must be given freely if the convulsions recur time after time. If the child can swallow, 3 to 5 grains may be given to an infant of six months to a year old, and repeated every hour or two for several doses, according as the convulsions are present or not; smaller doses, less often repeated, should be given if improvement takes place. No harm is likely to ensue by pushing the bromide. The bromide may be given by the rectum if necessary. Chloral in some cases more useful than bromide, but it must be used more sparingly; a two- or three-grain dose may be given to an infant under a year, and repeated in an hour if the convulsions are still present; but its soporific effect must be watched. Chloral, we are inclined to think, is more useful than bromide in convulsions due to colic or whooping cough. Bromide, chloral, and camphor infusion are often given in combination with advantage in convulsions. Cold to the head in the form of ice or wet cloths should be used if meningitis is suspected, and the infant should be carefully protected from all excitement.

Convulsions in infants a few weeks old, who are artificially fed, are due in the large majority of cases to *dyspepsia*, and no time should be lost in procuring a wet-nurse, or at any rate in giving the infant the most suitable food that can be procured. The bromides will have but little effect in stopping the convulsions as long as acute dyspepsia or colic is present.

Tetany

The term 'tetany' is applied to a form of tonic spasm mostly affecting the extremities, which, like spasm of the glottis, consists in a reflex contraction of a group of muscles, the result of irritation in some distant part. Tetany may affect both children and adults, though it is commoner before the age of three years than after this period. It is frequently associated with ticks, in this respect resembling convulsions and laryngeal spasm; it frequently occurs in connection with laryngismus. It rarely makes its appearance in healthy children, but in those who have suffered from some exhausting disease, especially some affection of the alimentary canal, as diarrhoea or acute enteritis; prolapse of the rectum may be an exciting cause. Difficult dentition appears to be an occasional cause. One of the most severe cases we have seen was associated with a fatal attack of acute enteritis. It has been observed in rare instances as an early symptom in pneumonia and other diseases, in this respect resembling convulsions, and tonic contraction of the muscles at the back of the neck. It has sometimes prevailed epidemically among school girls, but in such cases the muscular contractions were no doubt due to hysteria.

Symptoms and Course.—The attacks consist in spasms of the muscles of the extremities, more especially of the forearms and feet. There is no loss of consciousness, and usually no spasm of the facial muscles, though there is mostly an expression of pain on the face when the cramps come on. In the severer cases the arm is adducted at the shoulder and fixed to the side, the elbow is flexed at right angles, the forearm pronated, the wrist flexed, the thumb turned in, while the fingers are in the position of interosseous spasm, or the knaps may be clenched over the thumb. If the former, the metacarpophalangeal joints are flexed, while the other phalanges are extended.

In the lower extremities the foot is in the position of talpa squame or equino-varus, the plantar surfaces being hollowed out and the toes bent. The knees may be semi-bent and the thighs adducted. The muscles of the calf are hard and rigid, feeling as if gathered up into a ball (see fig. 100).

There is usually oedema of the dorsum of the feet and hands, from interference with the venous circulation.

The contractions are evidently painful; the infants scream when they are handled or interfered with; the spasms may remit, but usually last a considerable time. In rare cases, notably those recorded by Chocoma, the muscles of the face are thrown into spasm; in other cases the muscles of the jaw, abdomen, neck, and back have been affected. More commonly the spasm is confined to the hands and feet, or the hands only may be affected. The spasm lasts from a few minutes to many hours or even days, then disappearing and perhaps appearing again. Most of the muscles of the body are in a condition of irritability, especially those of the face. This is



Fig. 100.—Tetany affecting hands, also (muscle) of neck.

widened by the readiness with which they contract when the facial nerve is irritated. If the finger be passed smartly over the angle of the mouth, a sharp contraction of the levator follows; or the finger is brushed across the outer side of the orbit, and a contraction of the orbicularis ensues. This 'facial phosphenism,' however, is not peculiar to tetany.¹

The same irritable condition of muscles can sometimes be demonstrated by compression of the large nerve trunks of the arm, which may give rise to muscular spasm in the hands and fingers. This is sometimes referred to as 'Trousseau's phenomenon.'

Tetany never terminates life for it, as it only affects the muscles of external relation, though the child may die from the effects of the gastro-enteritis of which the muscle cramps are only symptoms. The only case which terminated fatally, which we have seen, was the case, referred to above, of a boy aged six years, who died in a few days from the effects of a gastro-enteritis; the principal symptoms were constant vomiting, cramps in the stomach, and tetany of both upper and lower extremities. The post-mortem

¹ J. Linn. M.D., *Blosser's Jour. Hygiene*, No. 39, 1891. 'Laryngismus' (H. W. Gray, *Brit. Jour.*, January 1890).

showed the brain and cord to be normal to the naked eye; the mucous membranes of the stomach and intestines were injected, and evidently in a state of acute catarrh. In another case, somewhat similar, Harder could find no changes in the cord.

Tetany is apt to return from time to time after a considerable interval; this may be noticed in cases removed into hospital—these mostly get well quickly and go home, but in another week or two are as bad as ever.

Diagnosis.—Tetany may be mistaken for cerebral spinal meningitis, but it can only thus be mistaken when the constitutional symptoms accompanying the tetany are severe. In tetany there is an absence of cerebral symptoms as well as vomiting and fever. In tetanus the spasm of the masseters is an early symptom; it is absent in tetany, or comes on late in the attack. The position of the fingers is different in the two diseases. In girls or older boys hysterical contraction might stimulate tetany, but the former usually affects one limb, or an arm and a leg only, while the latter is always bilateral.

Treatment.—The treatment must be directed in the first place to the ruling cause. A dose of calomel or grey powder should be given if there is any gastro-intestinal disturbance or undigested food lodged in the intestinal tract, and the greatest care taken to give only the blandest food. Warm baths may be given to relieve the spasms, and hot liniments frictions applied to the hands and feet. Bromide of potassium is likely to relieve the symptoms if given in full doses. Chloral, belladonna, digitalis, and Calabar bean have all been used with benefit. Chevalier found the $\frac{1}{16}$ to $\frac{1}{8}$ grain dose of Calabar bean of use in one case.

Nystagmus.—Nystagmus is common during both infancy and childhood and accompanies very different conditions. If usually constant is short, rapid oscillations of the eyeballs in a lateral direction, the head sometimes moving also. In some cases the ocular movements are vertical instead of lateral. It may be present in congenital cataract, tumours of the brain, hydrocephalus and hereditary ataxia; but it is also present in children who are not suffering from any organic disease. It may be present in some forms of chronic spasm of the neck.

Head-nodding and Head-shaking, going on constantly as they sometimes do in infants and young children, are the result of a chronic reflex spasm of the sternomastoids, either both acting together and making a nodding movement, as in expressing assent, or acting alternately and shaking the head as if expressing dissent. The movements may be constant or intermittent, perhaps ten or twelve times an hour. Nystagmus may be present. These curious spasmodic affections appear to be allied to laryngismus. Dr. Gee records a case whose brother died of laryngismus, and in one case of 'head-nodding,' mentioned by A. Baginsky, the child suffered later from convulsions and laryngismus. Head-shaking in older children Dr. Gee connects with epilepsy. The prognosis is good: like laryngismus, these affections appear to be due to some reflex irritation in the alimentary canal or to dentition.

'**Head banging**' in children has been described by Dr. S. Gee. It consists in a peculiar habit to which some children are liable, of turning over on to their face at night and banging their heads into the pillow. Dr. Gee

records three cases: two of these were two and a half years of age, and one was five years. One child used constantly, nearly all night, to bang his forehead into his pillow. No cause was found to account for this strange habit. It appeared very invariable, but one child much improved while living in the country.

Hysteria.—Functional nerve disturbances, in the form of sensory derangements, paresis, contractures, or *milanspols*, are by no means uncommon in children. Hysteria when it occurs during early life mostly affects girls, but it occurs also in boys; the approach of puberty is the most common period.

A tendency to hysteria runs in families, and is transmitted from parents to children, but the injudicious way in which children are often brought up, their weaknesses pampered and their ailments intensified by an injudicious sympathy, often tends to aggravate an hereditary disposition to nerve diseases. While it most frequently happens that hysterical children come of nervous families and belong to the well-to-do classes, yet such children may be found in country districts among country folk, where neurotic tendencies might be least expected. 'Fainting girls' who have had a temporary palsy, 'chaleptics,' and religious maniacs have been found in cottage houses and among surroundings that one would have supposed were little likely to foster hysterical affections.

Hysteria in its milder or severer forms is often associated with other diseases, such as epilepsy, chorea, and various mental affections; it may also be engrafted on to organic brain disease, such as meningitis or some spinal affection. Hysterical phenomena are rare before the age of six years and are most common about puberty, especially in those cases where menstruation has failed to become established.

Symptoms. *Sensory Disturbances.*—Perhaps the most common form of hysteria in girls is *hyperæsthesia*; there is a complaint of tenderness or pain which cannot be accounted for except by a *neuritis*. There is some local tenderness about the spine or one of the joints, especially the hip, the girl screaming with pain when the joint is moved; the thyroid gland or horn of the larynx is sometimes hyperæsthetic. Headaches are very common; these may be frontal or occipital, or may take the form of the 'claves' of adults. Hysteria is apt to mimic various diseases which are normally accompanied by severe pain, such as peritonitis, pleurisy, rheumatism; it must, however, be always borne in mind that there may be some actual disease present, and that the sensory disturbance is only an exaggerated condition of what would normally exist.

Anæsthesia is much less common in children than *hyperæsthesia*; but hysterical *hæmanæsthesia*, in which the special senses are involved, occasionally occurs. Sleeplessness is not uncommon, the patients asserting that they cannot sleep, and only perhaps dozing off when it is time to get up.

Motor Disturbances.—Paralysis, or rather paresis, is common; the legs are perhaps most frequently affected, but paraplegia is not infrequent. Hysterical aphonia in girls has the same characters as in adults; there is loss of voice, the patient always speaking in a whisper; sometimes the voice is entirely lost.

Paraplegia may come on suddenly after a convulsion, or the legs may

gradually give way under the child, until she can no longer stand, and is therefore confined to bed. There may be loss of sensation, but it is our experience this is uncommon. The loss of power is never complete: the patient moves the legs in bed, and often some attempt will be made to stand with help, or she may draw up the legs to prevent them touching the ground, and will sink to the ground rather than support her own weight. The electrical reactions are normal, and usually the knee-jerk is also normal, and there is no ankle-clonus. In other cases, more especially those which have lasted some time, there is more or less tonic contracture of the legs: the hip and knee-joints are stiffened, and the foot takes the position of equinovarus. In this condition, if the spasmodic contraction is not too marked, there may be excessive knee-reflex, and ankle-clonus may be present: if there is marked contracture, no knee-reflex can be obtained on account of the rigid contracture of the opposing muscles. The contracture is present during sleep, but usually goes off when the patient is under chloroform.

In hysterical paraplegia there is no incontinence of urine or feces: this is certainly the rule, but retention of urine will occur, and in some conditions, such as 'hysterical chorea,' both urine and feces will at times be passed involuntarily. We have seen on several occasions girls who were suffering from hysteria, simulating hip disease or peritonitis, pass their water in bed, so that the bed and linen have been saturated with stinking urine, rather than use a bed-pan, as they were afraid of being moved on account of the pain it caused. In such cases bedsores may form and the patient become emaciated.

Convulsive Attacks.—These are of the usual hysterical type. There is a fit of screaming or crying or violent laughter, tonic contraction of the muscles, more especially of the back, so that opisthotonos is produced: the arms and legs are dashed about and the head perhaps made to strike the pillow or bed violently. The patient remains conscious during the attack, and she rarely injures herself, and the tongue is not bitten. The so-called 'hysteroïd' fits have already been referred to (p. 499).

Meek's Syndrome.—Hysteria is closely allied to some forms of insanity, and various forms of hysterical insanity occur in girls about puberty. One of the commonest of these is a refusal of food. The girl's appetite becomes poor, she gradually grows thin, and this excites the sympathy and alarm of her friends. The morbid craving for sympathy becomes intensified. She resists all their entreaties to take food, and clenches her teeth when it is offered, or only takes the smallest quantities, and frequently is guilty of feces, concealing food in her clothes. She gradually wastes till she becomes a perfect skeleton, the skin is rough and harsh, the abdomen flattened, and the breath foul. Bedsores not infrequently form. In other cases, though refusing all food at meal times, she will surreptitiously obtain cakes or confectionery, which she will eat readily. In some of these cases there is melancholia or eclampsia. Marked consciousness is sometimes present: the girl perhaps takes away marks from herself at school, or accuses herself of having told untruths or of having stolen her schoolfellow's things.

Pneumia and Spasm of the pharynx are not uncommon, one or other of these may be present for months and lead to wasting. Usually the food

returns at once or within a few minutes of taking. Sometimes the food will be retained, but there is nausea and retching.

Diagnosis.—The first step in diagnosis is necessarily to attempt to exclude organic disease, which hysteria so often mimics. In several historical disorders, such as headaches, and in various forms of paralysis, the question is whether or not there is cerebral or spinal disease. Probably the commonest mistake is to assume that organic disease exists when the condition is one of hysteria only; but, on the other hand, we have known the symptoms in the early stages of a cerebral tumour attributed to hysteria. It is often necessary to wait before a definite diagnosis can be arrived at. But it is always necessary to bear in mind that an organic lesion may exist and yet undoubted hysterical symptoms be present.

Treatment.—The treatment of hysteria in its various forms is infinitely varied. The management of the patient must pass from the parents to a suitable nurse, or, better still, the patient should be removed to hospital or his lodgings away from his friends. If once the child is under firm control, it is deprived of the morbid sympathy it craves for, and, at the same time encouraged to put forth all its voluntary power, an improvement in its condition will immediately begin. In cases of paralysis, in addition to isolation from the parents and all sympathising friends, massage and faradisation are of much advantage. The patient must be made to see the weakened limbs in motion, and encouraged to believe that they will get entirely well.

In less severe cases change from city to a healthy country life is of great importance. Life at a farm with its many outdoor amusements and occupations is perhaps the best adapted for hysterical children. Effort must be made to interest them in many things outside themselves in order to break the vicious habit of dwelling morbidly on their own feelings and ailments. In many of these cases the general health is poor and menstruation delayed. In such, iron in the form of bicarbonate of iron, as in Fletcher's syrup, is useful, while the bowels should be regularly acted on by small doses of aloin, or some mineral water such as Rubinst or Harpady János.

Headaches.—Children, especially girls of seven years of age on to puberty, are very liable to headaches, sufficiently severe to lay them up for part of a day or perhaps longer. These headaches may arise from various causes, and it is important to try, if possible, and ascertain their origin. diagnosis is frequently by no means easy, as pain is referred to the forehead in many different incited states and conditions. Frontal headache is by far the commonest form of referred pain. It is important in the first place to exclude hypermetropia as a cause of frontal headache. Smearing the accommodation of the eyes, especially when the subject is below six, may give rise to frontal headache, aching being referred to the eyeballs. When at the same time, when an attempt is made to read, the letters run together and the eyes easily water. A diagnosis is easily made with the ophthalmoscope, examining the retinal vessels by the direct method, as well as by the use of test types.

Headaches are very common in rapidly growing children who are, in use an ordinary expression, 'outgrowing their strength.' Such headaches may be due merely to weariness or to the irritable state of the system which comes on when over-tired or fatigued; or they may be due to anaemia or

dyspepsia. The latter is probably the most frequent cause. The appetite may be good or capricious, more food is taken than the digestive organs can cope with, and dyspepsia or a seductive gastric or intestinal catarrh is the result. A sick headache is complained of, the child looks heavy and dark about the eyes, there is nausea or actual vomiting, perhaps some fever, and it takes a day or two to regain the ordinary state of health. Headaches due to overwork of the eyes and brain are especially common in schoolboys and girls when preparing for examinations and taking too little exercise and recreation. With the headache there is often sleeplessness at night, anæmia, and more or less dyspepsia. There is usually no difficulty of diagnosis here, as the history of the case will render its nature plain.

There is a form of headache which is by no means uncommon, which is distinctly neurotic, and which does not appear to be connected in any way with dyspepsia, sluggish liver, overwork at school, or organic disease. The child is usually a girl of ten or twelve years of age, who suffers with a severe headache, often accompanied by sickness, once or twice a week, perhaps often, which comes on at irregular times, and is sufficiently severe for her to take to bed or to lie on the sofa for most of the day, and to incapacitate her for all work or play. Such headaches are made worse by noise and exertion; at times there is violent sickness or retching, and perhaps giddiness in the erect posture. The bowels are usually constipated, the tongue clean, and in the intervals between the attacks the child is in good health and able to go to school and take moderate exercise. The causes of such headaches are very difficult to discover; a tendency to such is often hereditary, and, while worse during the period of puberty, the tendency may remain throughout life. They are often very obstinate, and medicine fails to relieve as long as the patient remains at home, leading a sedentary town life; they are almost always better during the holidays spent away at the seaside, or whilst leading a healthy country life, but recur again when a return is made to town life, with school and the ordinary home routine.

In some other cases the headaches are more distinctly hysterical, the pain being described as of a 'shooting' or 'boring' character, and coming on when the spirits are depressed or when there is some unpleasant duty or distasteful study to be undertaken. On the other hand, all headaches are forgotten if the patient is roused by some excitement or the prospect of some sensual pleasure. When the headache is present, the patient demands the sympathy of all her friends, and is apt to lapse into a chronic invalid, expecting to receive the considerations and attentions of the whole household. She objects to exertion of any kind; the least noise or loud talking brings on the headache. The appetite perhaps becomes poor, she becomes thinner, and the whole health suffers, or, on the other hand, in some cases the appetite is not affected. These hysterical headaches are commonest at or about puberty, when menstruation is commencing, but they may be present in boys and in girls of nine or ten years of age.

The most important question in connection with diagnosis is with regard to the presence or absence of organic disease. Are tubercles forming in the meninges of the brain? Is there a cerebral tumour, or are the headaches merely reflected from the digestive system or purely nervous in character? The diagnosis between cerebral disease and functional disease is usually not

difficult if the history given by the friends can be relied upon, and there is an opportunity of watching the patient for a few weeks. The headache accompanying the early stages of tubercle of the meninges is associated with irritability, wasting, hectic fever, loss of appetite, shivering, and cough; and a few weeks more or less will almost certainly see developed more marked cerebral symptoms, such as rigors, vomiting, and involuntary prostration of forces. The headache due to cerebral tumour is usually constant, though worse at times than at others; it is always made worse by movement; there are usually and apparently painless vomiting and optic neuritis.

Treatment.—The treatment of headache is naturally directed to removing the cause. The treatment of headaches of rapidly growing children will mainly consist in the avoidance of over-excitation or fatigue, a very moderate amount of brain-work, a healthy country life, and a careful regulation of the diet. The digestive organs are probably being given more work than they are able to perform, a gastric or intestinal catarrh is set up, and the disordered state of digestion is expressed by a frontal headache. Vomiting in these cases usually always relieves the headache; if it does not take place, perhaps there may be feverishness, nausea and headache for a day or two. When these headaches are coming on, the simplest and best remedy is an emetic such as a teaspoonful or two of ipecacuanha wine, to be followed by a little palatable starvation or the lightest possible diet for a few days. For the avoidance of such sick headaches meat should be allowed in only moderate quantities; it must be well cut up and masticated slowly, and care should be taken to regulate the bowels from time to time with some effervescent citrate of potash, Bismarck or Carlsbad water, before breakfast. In the neurotic form of headache, arising independently of digestive derangements, the treatment is often very unsatisfactory. When the attack comes on, and is evidently severe, bed is the best place, with a folded handkerchief on the head in the hope of getting the child to sleep; coffee, effervescent citrate of caffeine (1 to 2 grains of the pure salt), naseleconide of camphor (1 to 2 grains), ext. guaiacum liq. (10 to 15 drops), ext. cascubis indica, or belladonna are often beneficial. Antipyrin (2 to 3 grains) has been used with good effect. In the intervals between the headaches the most important treatment relates to regulating the bowels and to insisting on a simple but nutritious diet. In some cases good has followed the entire avoidance of butcher's meat (Haig). A healthy country life or change of scene is often of the greatest service, and generally effectively cures, for a while at least. In hysterical headache the patient should be encouraged to take as much interest in some work or play.

CHAPTER XXII

DISORDERS OF THE NERVOUS SYSTEM—continued

Speech Anomalies

During the first year of life the infant is unable to express itself by means of intelligent speech, nor does it make much progress in the understanding of spoken words. Yet from the earliest months it makes its wants known in a sort of way by the tone and manner of its cry; it can in this way express pleasure or grief, and it can interpret to some extent the meaning of what is said to it by the tone of voice in which the words are spoken and the gestures by which they are accompanied. A cry is the first sound uttered by the infant, and crying is indulged in pretty freely to express any form of discomfort or a feeling of neglect, and at first with but little variation. Within the first two months (five weeks, according to Preyer) variations in the tone and strength of the cry occur, indicating acute pain or hunger or impatience. Later still the cry becomes more distinctive and expressive, and the cry of anger or disappointment may be distinguished from the cry of hunger. Smiling may be observed by the end of the second month or earlier (twenty-third day, Preyer), but really noisy laughter is not heard till several months later. Other facial expressions, such as frowning, rage, distress, are noted later in the first year. From the earliest months the infant 'babbles' or 'crows' when pleased or in a good humour. It seems to take a pleasure in exercising its organs of speech, in much the same way that it derives pleasure from lying on its back and kicking vigorously in an aimless sort of way. Both consonant and vowel sounds are produced in great profusion, but in an irregular and unco-ordinated fashion. Preyer noticed that in one of his babies all the vowel sounds and all the consonant sounds were used during the first seven months except *m*, *n*, *l*, and *sh*; all the latter were postponed till the second year. By the end of the first year some of the main consonant sounds, such as *m-m-m-m*, *h-h-h-h*, *dada*, *nana*, are repeated in a meaningless sort of way, but before long they are applied to persons and things. Some of the earliest sounds acquired are those made by domestic animals, and the child quickly uses the sound to name the animal. During the second year the vocabulary increases fast, the child quickly imitating and repeating the words it hears, so that by the end of the second year it not only uses a number of words, but can string a few nouns and adjectives together, and has learned the meaning of short phrases. Thus we find such short sentences used as '*Kennie come by morning's bed*,' or '*Kennie so tidy puddling*.' At this period, and for the next year or two, words are instinctively or unproperly pronounced, with a tendency to dip

them short or to drop consonants. Some consonants present greater difficulty to the young child than others, and are constantly dropped out of words: thus *t*, especially when it precedes another consonant, is missed, as *roof* for *school*, *back* for *spoon*, *no* for *now*. Difficulties often arise with the aspirate dental *s* (*sh* and *ch*): *shut* becomes *Kuf*; the vibratory consonant *r* is a great unifying block, and the distinct pronunciation of it, perhaps, never acquired: *grad* is apt to become *grow*, and *roof*, *muf*.

Some children are more backward in talking than others, and are at the same time behindhand with walking and cutting their teeth, and it is only after the end of the second year is passed that they begin to make progress. This frequently happens with tickety children, or with those who have had some serious disease to contend with. Other children not only do not begin to talk when the usual time arrives, but as months and years go on make no attempt, or their articulation is indistinct and imperfect for their age. In another but smaller class the child learns to talk fairly well or imperfectly, then an illness comes on and it loses the power of speech. The principal causes of imperfection, or absence, of speech may be tabulated thus:

1. *Deaf-mutism*.—The infant may be born wholly or partially word-deaf or may become so from the effects of disease. The child is mute because it is deaf.
2. There is some physical defect in the formation of the mouth or vocal apparatus.
3. The child may be feeble-minded, or have some defect of the brain.
4. There may be aphasia associated with right hemiplegia or due to some functional cause.
5. The difficulty of speech may be due to stammering or hesitancy of speech.

1. **Deaf-mutism.**—Deaf-mutes are those who cannot speak because they cannot hear: the deafness may be due to congenital defect, or they may become deaf through illness before they have learnt to talk; as a rule, if the child becomes deaf before he is seven years of age, dumbness will result. The congenital variety appears mostly to be the result of hereditary taint, congenital deafness having occurred previously in the same family. It is doubtful if the marriage of cousins has anything to do with it. The morbid anatomy is very uncertain, as there are but few *post-mortem* records of such cases; in some cases there is reason to believe that congenital deafness is the result of inflammation of the internal ear during intra-uterine life. How early is it possible to detect deafness? The diagnosis is necessarily very difficult during the first few months of life, especially when we remember that congenital deafness is rarely complete, the ringing of bells, whistling, &c., being heard when the ear is quite incapable of detecting articulate sounds. 'Word-deafness' is congenital as well as the result of disease. During the first few weeks after birth the healthy infant gives no response or signs of recognising sounds, but loud noises will wake it up. It is only during the third and fourth months that the infant appears to recognise sounds and voices, but, as some infants are more backward than others with regard to perceptions, it is only after six months of age, or from that to a year, that a definite knowledge can be come to with regard to deafness. When the infant is a year old, and has never uttered an articulate word, while it shows no signs

of intelligence in other ways, and its muscular power and growth is in accordance with the normal standard, there is strong reason to believe that its speech defect is due to deafness. The diagnosis between a failure to speak due to partial deafness or word-deafness and failure on account of mental feebleness is often extremely difficult, perhaps, in certain cases, for a time impossible, in the absence of other signs of mental defect.

Acquired Deaf-mutism.—When a child under seven years loses its hearing in consequence of disease, its speech becomes indistinct and more or less unintelligible, and it loses the power of speech altogether, either quickly or gradually, according to its age and intelligence. The loss of speech will proportionally depend to some extent upon the amount of deafness. According to Hartmann it is possible, if the child is intelligent, and great care is taken to correct its mistakes in talking and to induce it to talk, that speech may be retained.

The lesion which commonly produces deafness is an inflammation of the labyrinth, either idiopathic or secondary to meningitis, scarlet fever, typhoid, or whooping cough. The difficulty of distinguishing between acute otitis and meningitis has already been pointed out (p. 250), and consequently the extent to which deafness is produced by one or the other is uncertain. Attacks of cerebro-spinal meningitis undoubtedly frequently produce deafness, as does also scarlet fever. In this country scarlet fever plays a more important part than other diseases in destroying the auditory apparatus. Hartmann believes that an inflammation of the labyrinth and consequent injury to the terminal apparatus of the auditory nerve, and not suppuration in the middle ear, is the cause of deafness; though the latter frequently takes place, it is not necessarily present. A naso-pharyngeal catarrh seems to be an occasional cause of labyrinthine disease.

The hearing power of deaf-mutes is usually tested with a bell and tuning-fork, the two ears being tested separately. Statistics collected by Hartmann show that in 867 cases of deaf-mutism in different institutions 60 per cent. were totally deaf, about one-fourth (24·3 per cent.) heard sounds such as the ringing of a bell, while 15 per cent. heard words or vocal sounds when pronounced loudly close to their ears.

3. Physical Defects in the Mouth.—Parents not infrequently bring a child to consult a medical man with regard to his backwardness or indistinctness in speech, which is attributed to his being tongue-tied or to some deformity of the mouth or palate. In the majority of such cases no physical defect can be detected, the defect being rather in the nervous mechanism of speech. It is quite conceivable that a more than usually attached frenum may be present and interfere, however slightly, with the movements of the tongue, and the dentals, *t*, *d*, *s*, are badly pronounced.¹ A highly arched or deformed palate may render speech imperfect, the child speaking like one with cleft palate; but it must not be forgotten that weak-minded children may have high palates and the defective speech be due to mental feebleness. Defective speech is also present in those with large tonsils and post-nasal abscesses; there is a characteristic 'stiffness' about the voice, and difficulties with the resonants *m*, *n*, *ng*, inasmuch as in the pronunciation of these the

¹ See 'Some Forms of Defective Speech,' Warrington Manual, *Lancet*, vol. 2, p. 111, 1885.

nasal chambers act as a resonating cavity. Paralysis of the soft palate may be present, especially after diphtheria, the voice having a nasal twang and difficulty being experienced in pronouncing the explosive labials *p* and *b*, as the air escapes into the nasal cavity, the soft palate failing to act.

3. **Mental Defect.**—Perhaps the commonest form of defective speech is that connected with the nervous mechanism. The child perhaps appears perfectly intelligent and bright, no defect can be discovered in the mouth, yet his pronunciation of certain sounds is defective, as if he used his tongue or lips imperfectly, or had not them under perfect control. He may have especial difficulty with the dentals, such as *t*, *d*, *n*, and consonants which require great precision in the use of the tongue; or the difficulty may be with the labials, as *p*, *b*, *f*, or; or he may lip in an exaggerated manner. All degrees of difficulty of speech may exist: it may be so marked that no clear words conversation as much as possible, and expresses his ascent as his wants by signs. This form of difficulty of speech is often hereditary. It is possible that in some of these cases the hearing is at fault and the child suffers from partial word-deafness, in a similar way to a child suffering from colour-blindness, or a faulty development of the co-ordinating motor centre of speech. Some children talk a sort of gibberish which perhaps their brothers or sisters understand, but no one who has not been with them a great deal can make out.

If, however, instead of imperfect speech the child of five or six years of age does not talk at all, there is probably some mental defect, the child failing to understand what is said, or although it may understand the spoken, yet there is a failure in the process of converting thoughts into words.

4. **Aphasia.**—Children, like adults, may suffer from aphasia due to organic disease, or from a functional aphasia. In the former the aphasia may be the consequence of occlusion of the left middle cerebral artery, and be associated with a right hemiplegia, or a tubercular tumour may compress the left third frontal convolution.

Functional aphasia is not uncommon and occurs usually after exhausting fevers: as, for instance, in typhoid after the febrile stage is passed many months may elapse before the child speaks. It may occur after pneumonia: thus a child of two and a half years suffered from inflammation of the lungs in October; his mother said his talking left him while getting better. He didn't speak a word till the following April, when he said: 'Drink'; the following month he began gradually to talk again. (See also case, p. 490.)

The power of speech is lost suddenly at times in consequence of a nervous breakdown. Dr. Langdon Down records the cases of two brothers who had spoken well and understood two languages, completely losing the power of speech at the period of the second dentition.

5. **Stammering** occurs occasionally before the period of the second dentition; it is often hereditary, and it always ceases during a period of ill health. Boys are far more commonly affected than girls. It is especially apt to supervene in boys who are overworked at school, and who inherit nervous tendencies.

Treatment of Defective Speech.—The treatment necessarily depends on the

1 See Dr. W. B. Hadden 'On Certain Defects of Speech in Children,' *Journal of Mental Science*, January 1895.

case of the defective speech. Surgical treatment may be required in the first place; enlarged tonsils must be excised and post-nasal adenoids removed. Defects in the hard or soft palate may be remedied as far as possible by surgical and mechanical means. Special instruction in articulation, especially directed to the difficult words, must then be practised. For this purpose the teacher faces the pupil, showing him by exaggerated movements of his own lips, tongue, or larynx the positions they should assume to form the desired sounds, and practising the pupil in these movements. In fact, the oral method now so commonly in use for the instruction of deaf-mutes must be practised in all cases of defective speech.

The education of deaf-mutes has received much attention of recent years, more especially in Germany, and schools are now established throughout the country where the education of deaf-mutes is carried on on the oral system. By this system the senses of sight and touch are made as far as possible to take the place of the defective sense of hearing.

If the patient has become deaf after it has learnt to speak, everything must be done to assist it to retain the faculty of speech and to discourage the use of sign-language. The child must be encouraged to speak, the words that are wrongly pronounced being corrected as far as possible by showing the child the exact position of the mouth, lips, tongue, or larynx, and by making it repeat the word until it has pronounced it correctly. New words are taught in a similar manner, and by showing the child the objects, or pictures of the objects, taught.

The instruction of congenital deaf-mutes is most usefully commenced at six years of age; before this time it is difficult to fix the child's attention for sufficiently long together; indeed, many children do not manage to learn much till they are seven years of age. It need not be said that the training of deaf-mutes in the use of oral language is a tedious and difficult process, requiring a special training and much patience on the part of the teacher. The deaf-mute has not only to learn to speak, but also to understand what is said to him by watching the movements of the speaker's lips. After many years of training the clever deaf-mutes are able to leave school and converse with others sufficiently to enable them to learn a trade and earn their own living.*

Mental Affections in Childhood

All degrees of intellectual feebleness are met with during infancy and childhood, ranging from complete *idiotia*, the result of an ill-developed or damaged brain, to mere backwardness or dullness of the mental powers. The classification of such is roughly made when we speak of *idiots*, *imbeciles*, and *backward children*, though in using these terms it must be borne in mind that no sharp line can be drawn between *idiots* and *imbeciles*, and, moreover, there are objections to both terms, inasmuch as the one is a term of reproach and the other is frequently applied to those who are the subjects of *senile dementia*. Dr. Langdon Down has proposed a classification based

* For details of the methods of oral instruction, see *Deaf-mutes*, by HARRISON (Gaskell's translation).

upon etiology, having the merit of simplicity, and which is often of practical value with regard to treatment and prognosis. His classification is as follows:

- | | |
|-----------------------------------|-----------------------|
| 1. Congenital idiocy. | 4. Cretinism. |
| 2. Developmental idiocy. | 5. Backward children. |
| 3. Accidental or acquired idiocy. | 6. Syphilitic idiocy. |

1. The **congenital** group includes by far the largest class, there is often some mal-development of brain or some brain-damage takes place early in intra-uterine life, and who in consequence are never in possession of an average amount of brain power. The members of this group usually die within a few months of birth that they see not like ordinary children. The mother notices that the infant when a month or two old does not take notice as it should do; it pays no attention to bright light or sound, it does not recognise its friends by a smile, or appear to hear its mother's voice. As time goes on it makes no attempt to sit up or hold toys in its hands, its muscular system is weak, and its face wears a vacant expression. At a year or eighteen months old it has made no progress in walking or in using its limbs, or perhaps it cannot utter any articulate sound; it salivates continually, the saliva running from its mouth on to its frock, and it has no control over its urine and feces. As its muscular power gradually increases, it learns to walk, perhaps to say a few words, and, if carefully looked after, to become more cleanly in its habits. At three or four years of age it cannot understand anything that is said to it, it takes no notice of anything in its daily walk, and can only utter one or two articulate sounds. Often they are nervous in their temper and mischievous.

The physical characters as well as the degree of intelligence possessed by congenital idiots are very various. They mostly have coarse, harsh skin, slow circulations, and suffer from constipation. They are exceedingly apt to suffer from various tubercular manifestations. They rarely develop much stature in growth. Congenital idiocy may be associated with a peculiar formation of the skull, corresponding roughly to the configuration of the brain inside; while some crania are small, it must not be supposed that small heads are constantly present in congenital idiots: in some cases the head is symmetrical and well shaped, and of average size. Congenital idiots may have microcephalic (Ance type) or small heads, macrocephalic or large heads, dolichocephalic or long heads, brachycephalic or broad heads (Mongolian type). Sometimes there is a want of symmetry on the two sides of the cranium, or there is a deficient development of the frontal or occipital regions. Various conditions of the mouth found in congenital idiots have been especially emphasised by Langdon Down; these, it is needless to say, are not universally present. The palate is inordinately high and arched, and often unsymmetrical; the tongue is usually large, and its movements are apt to be badly co-ordinated and awkward; the fungiform papillae are hypertrophied; the mucous membrane of the pharynx is apt to be thickened and congested, the tonsils hypertrophied, and poor nasal adenoids may be present, slaving due to paresis of the muscles of the lips and tongue, as well as to the hypertrophy of the glands of the mouth, is very common. Dr. Langdon Down looks upon slaving as of some diagnostic importance

being nearly always connected with mental feebleness. The teeth are late in appearing and quickly become carious.

2. **Developmental.**—In this group are included those who show no marked signs of being wanting in intelligence during infancy, but who during childhood or youth may show signs, often suddenly, of a mental breakdown and arrest of the development of the mental powers. This change may come at any time during childhood, but more especially on the approach of puberty. This sudden change often comes as a great surprise to the friends; the child's head is well-formed, he looks intelligent, quite unlike the appearance of an idiot, and they are at a loss to account for the change, or attribute it to some trifling disorder. Sometimes the first indication of the crisis is that the child ceases to talk: such was the case in a little boy seen by us, who was perfectly intelligent and bright up to 4½ years, when he suddenly ceased to speak and gave over playing with toys, his principal employment being to throw his toys on the floor and proceed to kick them about the room; he hardly seemed to know his mother, though at other times he appeared to understand. He eventually recovered.

In other cases the change comes at the second dentition or at puberty: such children are apt to be morbidly conscientious, believe they have told lies or stolen, or, on the other hand, they become wayward, mischievous, unkind to their brothers and sisters, and disobedient. (See Hysteria.)

Epileptic fits are apt to appear at this period. Dr. Langdon Down has noted that these cases often have a scaphocephalic head, which is 'pew-shaped' anteriorly, the pterion corresponding with the later frontal suture, which forms a prominent ridge. Such cases, according to this author, are apt to break down by over-pressure at school or from over-excitement during childhood.

3. **Accidental or Acquired.**—To this class belong those who do not inherit any insane tendency, and who would become healthy, intelligent children but for some accident which damages the brain at birth, or some lesion at a later period. Reference has been already made to cases of *Puerperal* paralysis (see p. 471) due to meningeal hæmorrhage occurring during birth; such are often not only paralysed, but mentally feeble. There is strong reason to believe, as already stated, that damage done to the convolutions on the surface of the brain by a meningeal hæmorrhage when an infant is in a condition of asphyxia is the cause of the feebleness of intellect, and possibly such cases may escape paralysis, the motor centres escaping damage. In another class of case the infant is quite well, and its development is satisfactory, till it has some acute illness with cerebral symptoms, mostly during its second year. This may be followed by hemiplegia, or there may be no paralysis, but the mental development is interfered with. Such children often suffer from convulsions and finally become epileptics.

4. **Cretinoid Idiocy. Sporadic Cretinism. Congenital Myxœdema.**—Cretinism is endemic in mountainous districts of Europe, especially in the Swiss Alps; it is comparatively rare in this country, though examples may be met with in the hilly parts of Derbyshire, Yorkshire, and Somersetshire. Examples of this form of cretinism may be met with in asylums. Dr. Shattlesworth records a remarkable case, who died at the age of twenty years in the Royal Albert Asylum at Lancaster. In such cases there is usually,

but not universally, an enlarged thyroid gland, and goitre usually prevails in the same localities.

The form of cretinism of most interest is the form which was described by Hilson Fagge under the name of "sporadic cretinism." It is, however, by no means unlikely that these cases are in reality more related to myxœdema than to the form of cretinism so well known in the mountainous districts of Europe. They differ from the latter in that the thyroid is absent, and the skin and subcutaneous tissues are thick and redundant.



Fig. 101.—George, Arthur F., aged 2 years 6 months.
at birth, weight 22 lbs.

Examples of this form have been met with in all parts of the country, and they do not seem to be more common in hilly districts than in large cities or in level country districts.

In many of the cases which have come under observation there has been a history of the child being born of healthy parents, and of being well till some illness occurred, such as measles or typhoid fever, after which the child ceased to grow and gradually developed the peculiar physiognomy of cretinism. In one of our own cases the boy was said to have been well till an attack of enteric fever at seven years of age; in a case recorded by Fletcher Beach the disease dated from whooping cough at twenty months. In other cases the history points to the child having been affected from birth. There is reason also to believe that cretinoid changes are in operation during pregnancy, and that some of the cases in which softening of the bones is supposed to be due to infantile micro-malaria are in reality fetal cretinism.

The physiognomy of cretins is very peculiar and characteristic. They are dwarfs, being markedly stunted in growth: in one of our own cases, that of a boy aged 12 years, he measured 34 inches high and weighed 28 pounds. In two cases of Hilson Fagge's, one, aged 16½ years, was only 32 inches high; another, 20 years old, was only 28 inches in height.

Their heads are large and broad, often flattened at the sides; the face is broad, the eyes wide apart, the nose flattened, and the lips are large and pouting. The tongue is unusually large and thick, and sometimes hangs from the mouth; the belly is tumid, the lower limbs are disproportionately short as compared with the body, the gait is awkward and waddling. The

skin is coarse and thick, and of a sallow colour; in some the subcutaneous tissues are thick and myxomatous. Usually no thyroid is present, or, if present, is very small, but in almost all cases described peculiar fatty tumours are present in the posterior triangles of the neck behind the sterno-cleido-mastoid muscles and immediately above the clavicles. These tumours are soft, movable, and lobulated; they send processes behind the sterno-cleido-mastoid muscles and also beneath the clavicles.

The degree of intelligence in these cases differs: mostly they are childish in their ways rather than imbecile. In one of the cases the boy was employed by his father, who was a butcher, to stand outside the shop on Saturday nights and shout out the price of meat. His peculiar appearance and quaint remarks always attracted customers. Girls are apt to suffer from tuberculosis both of the bones and internal organs.

Fig. 103 represents a boy of five years, the subject of cretinoidism was seven years from his birth, his brothers and sisters were healthy. He has never talked, only utters guttural sounds. Hardly understands anything said to him, but laughs if touched. The skin is coarse and subcutaneous tissues thick. He has large lips and tongue; his hands and feet are disproportionately large. No thyroid gland can be felt; the supra-thyroidal veins are present. He has rickets of the clavical bone and a chronic enlargement of pus from the left ear. Fig. 104 illustrates a similar case, four years of age; this could not stand without help.



Fig. 104.—Cretin.

All degrees of severity may be met with in congenital myxodema, and the slighter cases are very apt to be overlooked. In a case coming under our notice a child born deaf showed signs of myxodema, and greatly improved on taking thyroid extract. A sister and brother were also deaf (congenital), and curiously enough the sister has a much enlarged (cystic) thyroid gland.

5. **Backward Children.**—The name sufficiently indicates this class of case. It is often difficult to say whether a child is only behindhand in development or his mental powers are deficient. In most cases time will decide this. Backwardness is at times associated with epileptiform fits, or other nervous troubles. Children of this class are a constant source of

anxiety to their parents; they go to school and always grate to be at the bottom of their class, being perhaps left behind by their younger brothers or children many years younger than themselves; out of school they are bullied or teased by their playmates. It is often difficult to know what to do with them; certainly neither a large school nor home life is suitable. They are best educated in a small school where backward boys are received and special attention paid to them.

6. **Idiocy due to Congenital Syphilis.**—The statistics of asylums for idiots and imbeciles do not support the view that mental feebleness in children is due to any large extent to the results of inherited syphilis. Dr. G. E. Shuttleworth¹ records that out of 1,000 inmates at the Royal Allen Asylum for Idiots at Lancaster, in only ten cases was there any reason for suspecting syphilis, and in four only the evidence was satisfactory. We have already referred (pp. 458 and 462) to certain lesions, such as meningo-encephalitis and endarteritis, which give rise to brain softening and congenital dementia; but such cases are rare, and are usually fatal at a comparatively early period of life. The commoner form of syphilitic idiocy does not manifest itself till the child is some six or seven years old, or even later, and takes the form of a sort of dementia or nervous break-down. The child has perhaps learnt to read and shows a fair amount of intelligence; it then gradually becomes more and more stupid and dull, and finally becomes completely demented. In some cases there is some form of paralysis and a tendency to epileptic seizures. In all such cases it is important to inquire for a history of syphilis, and to carefully examine the patient for evidence of this. Keratitis, scarring about the mouth, pegged teeth, disseminated chondritis &c. should be looked for.

The changes found in the brain in these cases consist in a chronic inflammation and meningitis, there is also thickening of the skull.

Morbid Anatomy.—Space will not allow of any description of the malformations or lesions found in the brains of idiots or imbeciles. The number of malformation found are very numerous; the brain may be abnormally small, the frontal or posterior lobes may be ill-developed, the two halves may not correspond, or the corpus callosum or commissures may be absent. In another class of case there may be chronic meningitis, pachymeningitis or atrophy of the cortical centres.

Treatment.—The physical and intellectual training of children of deficient mental power is best undertaken in some institution specially equipped for the purpose. Home is certainly not the best place for their education. In the large majority of instances they are either over-indulged or neglected by their parents, brothers, and sisters. The association of the cleverer brothers and sisters often produces a feeling of discouragement in the feeble-minded, and of hopelessness at the wide gap which separates them from others. The discipline of a well-managed school or institution is of the greatest advantage in teaching them self-control and self-respect, and the compassion of those who are more or less on an equality as far as intelligence is concerned is calculated to bring out their mental powers far more than is the association

¹ 'The Influence of Hereditary Syphilis in the Production of Idiocy or Dementia,' by J. S. Berry, M.D.—*Brain*, Part XXI. 'Idiocy and Imbecility due to Inherited Syphilis,' by G. E. Shuttleworth, B.A., M.D.—*American Journal of Insanity*, January 1892.

with those that are greatly their superiors. If a school education is necessary for the children of parents who are in comfortable circumstances, how much more is the shelter of an institution necessary for the feeble-minded among the lower classes? The Board school refuses to be troubled with them; they are teased and worried by these comparisons in the streets, while they are alternately over-indulged or scolded and neglected by their parents; their life is miserable, and they grow up useless members of society and an embarrassment to their friends. Unfortunately the several excellent public institutions for the training and education of feeble-minded children in this country are too few in number for the work they have to do. Moreover, they labour under an unfortunate name, viz. 'Asylums for Idiots and Imbeciles,' when as a matter of fact they are not asylums for providing a home for useless members of society, but schools where weak-minded children are trained to take their part in the battle of life. These circumstances undoubtedly operate in the minds of parents, who might otherwise be not averse to sending their children to training schools, but who shrink from branding them as idiots or imbeciles.

As an example of what a training school can be, the 'Albert Asylum' at Lancaster may be taken as a model. Children are received of all degrees of mental deficiency, from the most feeble-minded idiot to the merely backward child; the children of the poor, who can contribute nothing towards their maintenance, are admitted; while there is an attached private house for the reception of the children of the wealthy, replete with all the comforts of home life.

It is needless to say that children who are idiots or weak-minded need a plentiful supply of good food; that especial care must be taken to keep their apartments warm as well as ventilated, as they are exceedingly prone to suffer from pneumonia and tuberculosis.

No provision is made in this country for the education of the dull or backward children of the lower middle or working classes. For children of ordinary intelligence the Board schools of our large towns provide an excellent education, but no special classes are formed for those of dull comprehension; they are refused admission to the ordinary classes, and frequently waste their time away at home, with no education at all. There can be little doubt that in all large towns in this country, as in Norway and Sweden, small classes should be provided for the dull and backward scholars, so as to obviate the necessity of refusing them an education, as is done at present. In the worst cases of this class, where there is real mental deficiency, education away from home is unquestionably the best.

Cranio-tomy.—Recently an operation under this name has been introduced, based on the fact that in certain cases of mental deficiency the defect is due to premature closure of the cranial sutures and consequent arrest of growth of the brain. The operation consists in the removal of a strip of bone along one or both sides of the middle line of the skull, or in some cases over the motor area, thus allowing the brain room to grow. The operation is a somewhat serious one, but has been followed by at any rate temporary improvement in some cases. We have tried it in two cases of hopeless deficiency, the result of infantile meningeal hæmorrhage, but in each condition, as might have been expected, no marked improvement followed. It is clear

that a good result can only be looked for when the brain is small and undeveloped, but not actually anywhere destroyed. Both our cases increased, but in our there was for a time marked hyperpyrexia, apparently a direct result of the operation less disturbance of the brain, and not due to septic causes; one of Mr. Horsley's cases died of a similar condition. The brain from one of our cases, which died some months after the operation from causes unconnected with it, is figured on page 479 (fig. 97).

Cases suitable for the operation are those in which there is mental deficiency with microcephalia and closure of the sutures, but no evidence of destruction of brain by hemorrhage or other injury.

The treatment of cases of congenital myxœdema with thyroid extract forms one of the most striking therapeutical advances of modern times. The effect in most cases is striking; under the influence exerted by a few grains of thyroid extract daily the child begins to grow, his intelligence improves, and he gradually loses the peculiar stilted look, so that in six or even three months the change is in some cases simply marvellous. It is well to begin the thyroid treatment by giving small doses, watching the effect carefully, and increasing as may be necessary, a dose equivalent to $\frac{1}{4}$ to $\frac{1}{2}$ of a fresh sheep's thyroid may be given daily. If the child becomes sick or feverish it must be omitted for a while, and the same dose may be given every other day. Rapid loss of flesh, weakness, slow pulse, should be taken as signs to reduce the dose. The treatment must be continued for months, and perhaps years, intermittently. In all backward, stunted children with rough skin and constipated bowels we should try the thyroid treatment.

CHAPTER XXIII

DISEASES OF THE NERVOUS SYSTEM—continued

Spina Bifida.

SPINA BIFIDA is a congenital malformation in which there is non-union of the laminae of one or more vertebrae, together with a protrusion of a sac composed of the spinal cord or its membranes through this opening. The deformity may be considered as due to a failure of the mesoblast to interpose itself between the spinal and cutaneous epithelium, with or without lack of condensation of the medullary folds themselves. The protrusion may occur at any part of the spine, and may extend throughout nearly its whole length; usually only three or four vertebrae are involved, and the lumbar or sacral region is the part most commonly affected.¹ Very rarely the bodies of the vertebrae are divided, and the lamina projects forwards or laterally. In some instances there is no protrusion, though the laminae have not united ('*spina bifida occulta*'), and occasionally there is more than one hernia.

Three kinds of *spina bifida* are recognised:

1. Protrusion of the spinal membranes only: '*spinal meningocele*.'
2. Protrusion of the membranes together with the spinal cord and nerves: '*meningo-myelocele*.'
3. Protrusion of the membranes and cord, the central canal of the latter being dilated to form the sac: '*syngo-myelocele*.'

To these should be added the cases where the medullary plates fail to coalesce—'*myelocele*'—and the central canal opens upon the surface, a condition incompatible with life for more than a few days. Also a *meningocele* may coexist with a '*syngo-myelocele*,' constituting a '*syngo-meningocele*,' and finally there is '*spina bifida occulta*.'

The second kind of deformity is much the most common, forming 62 per cent. of all the cases.

In the first form the swelling is usually small, and may protrude merely between two almost normal spines; the cavity of the sac is the subarachnoid space, the swelling is often covered with well-formed skin, and paralytic complications are often absent.

The vertebral laminae vary much in development: the gap may be very wide and the laminae much wasted, or they may form prominent everted borders to the orifice.

¹ Eighty-nine cases out of 122 collected by the Clinical Society were lumbar or sacral.

² *Phil. Trans. Roy. Soc. Lond.* February 25, 1858.

The central canal of the cord is often dilated in the first two forms as well as in the third, and the position of the cord in the sac varies; it may be slung up in the sac by a sort of meniscus, but in any case is very imperfectly developed, and is occasionally transited by a bony process crossing the canal.

Syringo-myelocoele is very rare; the sac is composed of spinal membranes *about* the cord, and, the cavity being the dilated central canal, the nerves are embedded in the sac wall and do not cross the cavity.¹

The fluid in a spina bifida consists of 98.9 per cent. of water with minute salts and a trace of sugar, or at least some copper-reducing substance; also small quantities of globulin; it is, in fact, cerebro-spinal fluid. Where, however, the cavity of the sac is continuous with the subdural space, no sugar will be found.²

In meningo-myelocoele, the common form, the sac is formed of dura mater lined by meninges (both 'layers'), hence the cavity is the subarachnoid space. The spinal cord traverses the sac and blends with its roof; from the flattened thinned-out cord the spinal nerves arise and pass across the sac to their respective foramina. The surface of the sac may be covered entirely with skin, or may be thin and transparent, only consisting in its upper part of the meninges, or meninges covered with an imperfect epidermic layer, while at the sides the skin is usually better formed. Sometimes a dimple or longitudinal furrow in the middle line marks the attachment of the cord and shows its presence in the sac, an important point in the question of treatment. Sometimes the sac is localized.

The tumour resulting from spina bifida is median in position, usually sessile, fluctuant, translucent in varying degree, according to the amount of healthy skin covering it. Lateral meningocele has been, however, met with. The contents can be partially reduced into the spinal canal, unless the communication has been shut off (false spina bifida). The surface is not uncommonly ulcerated, and is sometimes marked by navel-like tissue as in the case of meningoceles. The swelling becomes tense on the child crying, and there is often some associated deformity; hydrocephalus, meningocele, talipes, harelip, a peculiar webbed condition of the thighs ('sairen'), or other deformity may coexist, and the subjects of spina bifida are often marasmus and soon die; in other cases, however, they are fat and hearty. We have seen them too fat, the subject of a sort of diffuse lipomatous condition such as is sometimes seen in cases of talipes. On the whole, paraplegia, talipes, and hydrocephalus are the three commonest complications. 'Trophic' ulcers are sometimes seen on the feet.

Diagnosis.—The diagnosis of spina bifida can only be doubtful where there is a complete skin-covering to the tumour. In such cases congenital, caecal, or other tumours—hygrota, teratoma, or lipoma—may be mistaken for spina bifida, and the possibility of the communication with the spinal cord having been shut off must also be borne in mind. The presence of solid masses in a median tumour and the absence of general fluctuation would

¹ A case of this sort has been recorded by Munro in the *Brit. Med. Jour.* for March 1894.

² A case of this nature was reported by Peppers (Gard) in the *Can. Soc. Trans.* the injection cured the patient.

point to a teratoma or lipoma, while a hygroma is more spongy, usually flatter, and often not exactly median. The presence of nervous stains may raise the question of whether the whole swelling is not neurocid. The fixity of the tumour to the spine, its reducibility, the possibility of feeling the edges of the opening in the laminae, and the coexistence of other deformities may throw light upon a doubtful case. In some instances puncture with a fine needle and examination of the fluid drawn out may be required; a highly albuminous fluid would be inconsistent with spina bifida. Non-congenital tumours cannot, of course, be confounded with spina bifida. The persistence of communication with the meningeal cavities can be determined by variations in size of the swelling. The term 'false spina bifida,' usually limited to cases where the sac no longer communicates with the subarachnoid space, is sometimes applied to any median congenital tumour along the spine.

Prognosis.—Nearly all cases of spina bifida left to themselves die, mostly from meningitis after rupture of the sac, or from marasmus; some, however, recover completely, the sac shrinking up and forming a mere puckered cicatrix. Occasionally spontaneous cure takes place *in utero*, and even rupture is not universally fatal. Cure of the spina bifida, it must be remembered, does not imply cure of paralysis or other complications.

Treatment.—Though simple repeated tapplings, pressure, ligature, and excision have all occasionally proved successful in the treatment of spina bifida, the Clinical Society's report shows that the safest and most generally applicable plan is that of injection, and probably Morton's fluid¹ is the best for this purpose. Either ligature or excision is almost necessarily fatal where the case is one of meningo-myelocoele, and, as this is the most common form,² and it is impossible to be sure in any given case that a simple meningocele is present, the plan is only occasionally applicable.³

Treatment by injection is managed as follows: The child should be held back downwards, and a fairly fine injecting syringe should be charged with Morton's fluid; the needle is then passed obliquely through the skin and from fifteen minims to a drachm of the fluid injected. Care must be taken that the puncture is made through skin and not through thin membrane, and that it is well away from the middle line, both to diminish the risk of subsequent leakage and to avoid injury to the cord or nerves. After the injection, the child must be kept upon its back, the puncture sealed with collodion, the tumour packed well round with absorbent wool, and a flannel bandage applied. It is perhaps better to withdraw some fluid before injecting, and the child must be kept entirely in the supine position, to prevent the fluid from passing into the spinal canal. If the tumour does not shrink and no ill effects follow, the injection should be repeated at intervals of a fortnight. Occasionally the tumour does not begin to shrink for a month or two after an injection, as in a case related to us by Dr. Wallace, of Longsight.

¹ Iodine gr. x, iodide of potassium gr. xxx, glycerine ℥i. The amount of iodine may be increased up to gr. xxx.

² Prescott Hewett found only one case out of twenty in which there was no nerve element in the sac.

³ Mr. Mayo Robson, of Leeds, and others, have had some successful cases, but the facts remain as above stated.

Injection may fail to produce any effect, may result in immediate death, may be followed by leakage or by hydrocephalus; a single injection may cure, or several may be required. This plan should be employed in all cases unless the child is obviously moribund or dying from rupture of the sac, or unless the tumour is quiescent and giving rise to no trouble; in a course, if it is sloughing spontaneously, no treatment should be adopted.

Sometimes a spina bifida is ruptured at birth, or sloughs shortly afterwards from pressure; nothing can be done for such a case except to dress it over with iodoforn and protect it carefully from pressure and contamination with the child's discharges. We have not seen a case recover when the sac has been ruptured in this way, though recovery does occasionally occur (Mayhew). Superficial ulceration is less serious and should be managed in the same way. Even if the spina bifida is cured by injection, it is not

has been ruptured in this way, though recovery does occasionally occur (Mayhew). Superficial ulceration is less serious and should be managed in the same way. Even if the spina bifida is cured by injection, it is not



FIG. 101.—A view of a child with a large spina bifida (lumbar) protruding, with a large sac.



FIG. 102.—A view of a section through a spina bifida caused by injection. A small cyst is seen beneath the skin. The spinal cord and meninges are visible below.

rare for hydrocephalus to appear later; hence the mortality, death or idiocy, among these cases is very high.

As already mentioned, it often occurs the sac becomes shut off from

the general cavity of the meninges and the cyst remains without communication with any important structures; such a cyst can only come in meningocoeles; the tumour then usually requires no treatment; it may, however, be tapped or injected and excised with probable impunity. These cases and sacral spina bifida are the ones most likely to be successfully treated by excision.

In connection with spina bifida must be mentioned the so-called *occipital* or *occipital* dimple described by Lawson Tait and others. This is a small dimple or depression in the skin over the lower part of the occiput or upper part of the coccyx; it can often be obliterated by traction upon the skin. It probably results from imperfect obliteration of the dorsal lamina,

a sort of incomplete spina bifida. Fig. 107 shows a more marked condition of the same thing, which was associated with talipes. It has been pointed out by Dr. Derrig, of Jersey,¹ that the dimple may be associated with bending back of the neck. Another view of the origin of this little depression, which is quite commonly to be found, is that it represents the 'posterior fontanelle,' or 'Malgaigne.' It has been supposed to be the remains of the mesenteric canal. Congenital sacral fistulae are a more marked condition of the same thing: they may cause trouble by retention of sebaceous secretion and require removal: a tuft of hair or 'caudal appendage' has been found in the neighbourhood of these fistulae (Terrien, Guérin, &c.). The case here figured (Fig. 107) appears to be an intermediate condition between the ordinary spina bifida and the rare condition described as 'spina bifida occulta,' in which the lumbar or one or more vertebrae are deficient, but there is no hernial protrusion. In 'spina bifida occulta' the site of the deficiency is marked by a local overgrowth of hair, and there appears to be usually a coexisting (resulting) tendency in the development of perforating ulcers of the foot and perianus. We have noticed an overgrowth of hair and a formation of trophic ulcers in cases of spina bifida, cured by injection; both the hypertrophies and the ulcers developed only when the tumour was more or less completely shrunk. In such cases endarteritis and neuritis of the affected foot have been found, with great hypertrophy of the muscular coat of the arteries. In cases of spina bifida both manifest and 'occult,' paralysis and contractures of the lower extremities have been relieved by operation, and the removal of bands and thorns or fatty masses pressing on the cord or nerves.



Fig. 107. Single small spina bifida which has undergone spontaneous cure. The girl had also talipes, and was mentally dull. There was no skin on the forepart of the foot.

Meningocele

Malformations corresponding to spina bifida are not rarely met with in the head. The most common form is a hernia of the meninges forming a meningocele, the cavity of which is the subarachnoid space. In other instances the protrusion contains brain substance as well—encephalocele, or hydrocephalocele, or meningo-encephalocele; the last is, according to Torres, the commonest, and pure meningocele the rarest form.

These hernia are most common in the occipital region, the protrusion taking place through a median opening corresponding to the space between the centres of ossification of the supra-occipital bone. In other instances it occurs at the root of the nose, through the suture between the frontal and nasal

¹ *Lancet*, May 6, 1884.

bones, or at one or other angle of the orbit, or at other parts,¹ the pharynx &c. The general characters of these cysts need no further description here; they are precisely those of a spina bifida, except that the skin over a meningocele is more often normal. The fluid is often partially or wholly red, and its reduction may give rise to pressure symptoms; the swelling becomes more tense when the child cries, and is more or less translucent according to its contents, whether fluid or cerebral. The course of these cases is often the same as that of a spina bifida: the swelling grows and ruptures, and the child dies; sometimes, however, it shrinks after a without rupturing.

Diagnosis.—The diagnosis is in most cases easy: the swelling is in the position of a weak spot in the skull; it is congenital. The opening in the skull can usually be felt, and the other characters mentioned suffice to distinguish it. Sometimes, however, especially when small, it is difficult or impossible to distinguish meningoceles from dermoid cysts, or cysts connected with nerves, especially as neuroid patches are common on the surface of meningoceles. Dermoid cysts sometimes cause perforation of the skull



Fig. 101. — Occipital Meningocele.



Fig. 102. — Frontal Meningocele. Spina bifida, with resulting deformity of the spine. (See *Ward's text*.)

beneath them, and hence are very difficult in such cases to diagnose with certainty; they are, however, usually more mobile and less affected by pressure than meningoceles. The deformity is often accompanied by idiocy, paralysis, or spastic contractions, and other malformations. In some cases the protrusion may attain enormous bulk, the greater part of the cranial contents being lodged outside the skull. Most museums contain specimens of this sort, which have, however, no practical surgical bearing.

Treatment.—Unless the tumour is enlarged, no treatment except protection is wise; should anything be desirable, repeated tapings or injection, as in the case of spina bifida, is the best course for meningoceles. Attempts have been made to excise the tumours, with sufficient success to encourage further trials, in selected cases. We have successfully excised an occipital meningocele in which the tumour did not communicate with the meninges; but in the operation the meninges, or at least another sac, were opened.

¹ The late Dr. Channing has recorded a case of interparietal hydrocephalus (Edin. Med. Trans. 1871); and the protrusion sometimes takes place through the frontal region (Hutton, *St. George's Hospital Reports*, 1870) — in this case the cyst was isolated.

No ill result followed. If excision is attempted the skin should be as far as possible dissected back from the membranes, and the latter either tucked into the skull or removed and their edges stitched together. We have also treated an occipital meningo-encephalocele in which a piece of the cerebellum of the size of a walnut was removed; the child recovered, though it developed hydrocephalus after the operation.¹

Scharr reports favourably of the treatment of occipital meningoceles by puncture and pressure, and records a cure in three cases by constriction of the pedicle with clamps. (*Berlin. Klin. Woch.* 1885, No. 28, p. 371.)

Much deformity is sometimes produced by the presence and shrinkage of a meningocele (fig. 106, kindly given us by our friend Dr. Monte).

Occasionally meningoceles protrude through the roof of the pharynx or nasal cavities: in such cases mistakes as to the nature of the swelling have led to speedy fatal results after operation.²

Spinal Meningitis

Spinal meningitis mostly occurs in its acute form in association with cerebral meningitis, and in its chronic form in connection with spinal caries. Acute cerebro-spinal meningitis has already been referred to (p. 427), and the symptoms of spinal meningitis, when superadded to those of cerebral meningitis, discussed. The dissociation of the symptoms of each is not easy, as cerebral disease gives rise to symptoms closely resembling those given by a spinal lesion. Thus, basal meningitis, especially when it occurs low down around the pons, medulla, and cerebellum, will produce intimated rigidity with spasms of the muscles of the back and neck. A tumour of the middle lobe of the cerebellum may produce acute pain referred to the spine and spasm of the erector spine (see case, p. 465). On the other hand, spinal meningitis, either tubercular, simple, or purulent, may be found *post mortem*, having given no definite symptoms during life, certainly not those usually associated with spinal meningitis.

The most characteristic symptoms of spinal meningitis are shooting pain down the limbs and round the body, with hyperæsthesia of the skin, rigors, quickened pulse, and fever. There are rigidity about the limbs, retraction of the head, and tenderness about the spine. The diagnosis is often difficult: hysteria, tetany, and the cramps associated with acute intestinal catarrh, as well as cerebral meningitis, may be mistaken for it. Synovitis of the vertebral joints may resemble meningitis of the cord. If the spinal meningitis pass into the chronic stage, paralysis of the upper and lower extremities may come on.

Spinal meningitis is necessarily a disease which tends to a fatal termination, but not so certainly as cerebral meningitis: certainly, cases diagnosed as spinal meningitis recover. Cases such as the following are not altogether uncommon:

A girl aged 13 years complained six days before admission of pain in the back; her head was drawn back, she could not sleep for the pain. On admission she was evidently

¹ Mr. Jessop, of Leeds, also records a successful case of excision, but there was no distinct communication with the interior of the skull; hence it has little bearing on the present question.—*Brit. Med. Jour.* December 30, 1882.

² For tables as to the frequency of different varieties see *Third Manual of Surgery*, vol. i.

entirely ill; she lay on her side in bed, with her legs drawn up, and there was great swelling of the head; there was much pain along the spine, aggravated on movement, pain shooting along the arms was complained of; the pulse was soft, the temperature varied from 98° to 102° Fahr. She was given chloral hydrate, and an ice bag was applied to the spine; for five or six days she continued entirely ill, the temperature varying from 99° to 102°; there were several rigors on succeeding days; the head was retracted, and facile movement forward caused pain, there was exaggerated knee-jerk, and ankle-clonus was present. The symptoms gradually subsided about a week after admission, leaving her very weak and emaciated. In six weeks she was discharged well.

Such cases may be open to the suspicion that the inflammatory lesion present was in the vertebral joints or spinal muscles rather than in the spinal canal; but, on the other hand, some of the other joints or muscles were affected, and there is no reason why a spinal meningitis should occur and get well again.

Treatment.—Rest in bed, with perfect quietness, is essential. Ice to the spine is probably the best local application that can be used. The pain must be relieved by small morphia injections, or opium may be given by the mouth. Instead of opium, bromides and chloral may be tried.

Paraplegia

By far the commonest cause of paraplegia during childhood is compression of the cord from caries of the bones of the vertebrae. Other forms of paraplegia occur which may be due to myelitis, pressure on the cord by a tumour, following measles or other systemic disease, or white atrophic paralysis affecting both legs, and some other ataxic or paralytic of uncertain origin. There is also the spastic paralysis of cerebral origin and hysterical paraplegia.

Paraplegia from Pott's Disease.—It is important to bear in mind that the paraplegia which occurs in association with caries of the spine is less often due to direct pressure from the deformity produced by the falling together and bending of the vertebrae than to the inflammatory products which are thrown out around the cord. We may therefore have a paraplegia without the slightest external deformity of the spine, and, moreover, a perfect recovery may ensue in a given case by absorption of the inflammatory products—a result that could hardly be expected if the compression was due to the direct pressure of a bent spine. The inflammatory process which commences in the body of a vertebra is apt to spread, so that lymph or pus is effused outside the dura mater, between the latter and the bone, or inside the dura mater, and the cord is compressed, or the cord may also be affected by the inflammatory process. Pressure on, and inflammatory changes in the cord itself may take place at any part of the cord—cervical, dorsal or lumbal region. Pressure is also exceedingly likely to affect some of the nerves, the latter being surrounded and compressed by inflammatory products as they pass through the dura mater and foramina.

Symptoms.—Symptoms of compression of the cord or its branches may come on early or late in the disease. In the majority of cases the early symptoms are those connected with deformity of the spine and perhaps irritation of the sensory nerves, and it is only late in the disease, when the deformity has

been well marked for many months, that symptoms of pressure on the cord supervene. In the minority of cases it is the weakness and paresis of legs with exaggerated knee-jerk that suggest the onset of spinal caries. It is important to bear in mind that a paraplegia may exist for many months without any deformity of the spinal column being present, the latter eventually supervening, and explaining the cause of the paraplegia which had remained in doubt. Fowler mentions the case of a patient who had complete paraplegia for six months; an experienced surgeon who examined him was unable to detect the existence of spinal caries, and yet a few months later undoubted symptoms of bone disease set in.

The motor paralysis usually comes on gradually: the child is weak upon its legs, quickly tiring, and supports itself whenever possible by the help of chairs or tables. When the dorsal cord is compressed the reflexes are exaggerated; if the sole of the foot is tickled as the child lies in bed the foot is sharply withdrawn; if the knee is bent by holding the ankle in the operator's hand, a sharp tap on the patellar tendon gives rise to an exaggerated 'knee-jerk'; ankle-clonus can usually be readily obtained. Gradually a spastic paraplegia comes on: the child cannot walk, or later cannot stand, without help, and when lying down in bed the knees tend to draw up and the feet to be extended in consequence of the rigidity of the calf muscles. Usually there is no loss of sensation. The sphincters may be affected and bladder troubles may arise if the lumbar cord becomes involved by descending inflammation. Prior to the onset of motor or cord symptoms, there may be various shooting pains experienced along the intercostal nerves; children with commencing caries of the spine will complain of 'belly-ache' or refer the pain to the pit of the stomach or urethra. Thus pain referred to the umbilicus suggests that there is irritation of the tenth dorsal nerve (tenth dorsal vertebra), or pain at the criform cartilage to the sixth and seventh nerves (fourth and fifth dorsal vertebra), or over the thorax to the upper dorsal nerves. There may be hyperesthesia or anaesthesia of the skin.

When the cervical region of the cord suffers the symptoms are apt to be more marked than when the dorsal region is affected; there may be pains shooting down the arms, shoulders, neck, and scalp, according to the position of the lesion; hyperesthesia and later anaesthesia of the skin. The sensation of pins and needles is often complained of. There is gradual loss of power in one or both arms, and wasting of the muscles. The shoulder muscles, serratus, flexors of the elbow and supinators are affected when the fifth and sixth are involved; the extensors of the wrist and fingers when the sixth and seventh; and the extensors of the elbow, flexors of the wrist and fingers, and pronators, when the seventh and eighth are involved. A spastic paraplegia may come on, as in disease of the dorsal cord.

When the lumbar enlargement is compressed, or its branches, there is paraplegia, the reflexes are not exaggerated, but are abolished, and no knee-jerk can be obtained—that is, if the pressure is severe enough to interfere with the functional activity of the grey matter of this region. The sphincters, both of the bladder and rectum, are likely to become paralyzed if a compressive myelitis of the lumbar cord takes place.

The course of the disease varies exceedingly, and depends upon the extent

and chronicity of the inflammatory processes in the bowels. Recovery from the paralysis may take place after the patient has been bed-ridden and helpless for many months and even years, and where recovery was hardly thought to be possible. On the other hand, the progress may be from bad to worse, there being a gradually extending myelitis, so that the sphincters become paralysed and the patient suffers from incontinence of both urine and feces. Sensation may become impaired, and the patient at last dies of exhaustion or the results of cystitis, or not infrequently of tuberculosis or lardaceous disease. For treatment see Disease of Spine.

Myelitis

By far the commonest inflammatory lesion of the cord in children is that form which is localised in the grey matter of the anterior horns, which has received the misleading name of 'infantile paralysis.'

An acute transverse myelitis occurs in children, as well as in adults, but it is apparently less common. Disseminated or focal myelitis appears sometimes to occur during some of the pyrexial diseases, as typhoid fever or measles. Transverse myelitis is rare before the age of ten years; it seems mostly to follow exposure to cold or accidents, such as occur to school-boys in the football field. In one of our cases, that of a boy of eight years of age, it followed paddling in the water.

The symptoms are much the same as in adults; the ultimate chance of recovery is, however, greater, as the cord seems to recover itself more readily in early life than in later years. There is usually a feeling of 'pins-and-needles' in the feet, and sometimes described pain followed by loss of muscular power. At first this may be slight, but after a few hours it becomes more marked, and within twenty-four or forty-eight hours it has reached its height. There is loss of sensation as well as motion, varying in extent according to the length of cord affected. There is also incontinence of urine and feces; if the lesion is above the lumbar enlargement, the sphincters contract normally, but the control exercised by the will is cut off. The commonest part of the cord to be affected is the dorsal region; often there is some feverishness.

All degrees of motor and sensory paralysis may be present. In severe cases almost all power is lost and the legs fall about in a helpless way, though usually some power of movement is retained in the feet. The reflexes may be completely absent. After a variable period, if the lesion is above the lumbar enlargement, the reflexes return and become excessive; there is ankle-clonus, the knee-jerk is abnormally vigorous, and a condition of spastic paraplegia comes on. Sensation, if it has been absent, usually returns before recovery of motor power.

The amount of recovery which takes place is variable; we have seen complete recovery eventually ensue in cases where, from the amount of motor and sensory paralysis present in the first instance, we had not thought it possible. Many months in bed are necessary to effect this; the intense spastic paralysis gradually lessens and may eventually disappear.

If the lumbar enlargement is affected, not only is there complete motor paralysis, but the muscles waste rapidly, the rectal sphincter is completely

retained, and the urine dribbles away from paralysis of the sphincter of the bladder.

If the cervical enlargement is affected, the arms are paralysed, the pupils may be dilated, and death is apt to ensue from interference with the nerve supply to the muscles of respiration.

As an instance of a transverse myelitis occurring in the cervical region, followed by partial recovery, the following case may be related :

Transverse Myelitis.—A healthy boy when a year old was exposed to cold by lying on the damp grass; he was crying during the following night, the parents thinking he had pain in the stomach; he was not convulsed, next morning both his arms and legs were limp and motionless, he could not move them or sit up; there was no facial paralysis. Recovery gradually took place, the arms recovering completely, the legs partially. When now at two years of age, the arms had completely recovered, but both legs were weak, so that he could not bear his weight on them, but could crawl, dragging them after him; sensation seemed impaired in the legs, there was no clonus and exaggerated tendon reflex. The child was perfectly intelligent, and was well nourished, but the muscles of the legs were somewhat flabby. He has since been lost sight of.

As instances of what were probably cases of subacute myelitis, are occurring after measles and another after what was said to be a 'cold,' we may mention the following cases :

Myelitis following Measles.—Gertrude H., aged 4 years, was quite well till she contracted measles in August 1884; when convalescent it was noticed she could not stand by herself. She remained bedridden till admitted to the hospital in December. At this time she could not bear the weight of her body without help; the knee-jerk was exaggerated, the knee-leg contraction was present, there was no ataxic gait. She slowly improved, and by February 1885 she could stand alone and walk with help, throwing her legs forward. She finally entirely recovered after some months.

Myelitis.—George C., aged 13 years, was quite well till May 1885, when he caught a cold and had a feverish week then; after this his legs became weaker, though he could always walk with help. He was admitted September 1885; his legs were both weak, but he could walk, swaying from side to side, bending both knees very much; no loss of sensation, muscles react normally to both cutaneous and tendon currents; knee-jerk exaggerated, the slightest touch producing a jerk; there was no evidence of any special disease. He continued much in the same condition till January 1886, when he went home. He finally completely recovered, after attending as an out-patient for some months.

It is difficult to account for the symptoms in these two cases except on the supposition that they suffered from either compression or disseminated myelitis, which eventually got well.

Dr. Thos. Barlow records a fatal case of disseminated myelitis¹ occurring during an attack of measles, which proved fatal on the eleventh day of the disease. He quotes two cases of children, aged two years and three years respectively, who suffered from paralysis apparently due to myelitis when manifested from measles.²

Lindley's Paralysis. or acute ascending paralysis, is said to occur occasionally in children; the following case in many respects resembled this form as it occurs in adults :

Edward M.L., aged 18 years, had good health till January 1885, when he became ill from the effects of cold; in a few days he became drowsy and had twittings in the legs.

¹ On a case of early disseminated myelitis occurring during measles.—Dr. Thos. Barlow, *Proc. of the Royal Med. Chir. Soc.*, vol. 11, p. 146.

which were said by a doctor to be due to St. Vitus's dance; the movements ceased and left his legs paralyzed; eight days afterwards he lost the use of his arms, and he remained of palsy in the head and was dumb for a week; the weakness in the arms improved, but got worse again. When admitted in March 1881 his arms were weak, he moved his legs with difficulty, could just manage to raise them in bed; no loss of sensation; the knee-jerk was almost absent; no ataxic-chorea. He gradually improved, so that by April he was able to walk without difficulty, but could not read or write. He finally completely recovered. It is possible that this case was in reality one of peripheral neuritis rather than any spinal lesion.

Treatment.—Perfect rest in bed is of the greatest importance in the inflammatory stage, all movements and excitation of the spinal cord being avoided as much as possible. The patient should lie on his side or his face in preference to his back, so that the spine should not be the most dependent part. Of local applications the spiral ice-bag is probably the best, though some prefer the application of moist heat with counter-irritation, such as mustard poultices, so as to reddens the skin. Probably there are no medicines which can control or moderate the inflammatory lesion. Acetone, ergot, the bromides, have all been used with varying success. Both mercury and iodide of potassium have also been prescribed.

Great care must be taken to prevent bedsores; perfect cleanliness must be observed, and pressure taken off any spot where the skin becomes red. The incontinence of urine and feces is always a source of difficulty, as the urine and dung bed-sores fret the skin and give rise to sores. The best position for the patient is on his face, so that the urine as it dribbles away may be received into a bed pan. Boracic or ichthammum cotton wool may be used to surround the penis and absorb the discharges. If there is retention of urine, the catheter must be used. No good can be expected from the application of the faradic or galvanic current in the early or inflammatory stages; indeed, harm may not improbably be done by exciting and frightening the child. The more at rest the cord is allowed to remain, the better chance is there of absorption of the inflammatory material and recovery of function of nerve elements.

In the chronic stage good may be done by gentle friction applied to the muscles, and by the application of blisters or the actual cautery over the region corresponding to the disease. A change to the seaside, the patient being wheeled out in the open air in a recumbent position, is likely to expedite recovery by improving the general health.

Hereditary Ataxic Paraplegia, or Friedreich's Disease, is the name given to a form of ataxia which commences for the most part during early life, and which tends to affect several members of the same family. It most commonly appears during the period of the second dentition, or from thence to puberty. The most characteristic feature of the disease is a reeling gait, the patient waver about both in walking and standing, a constant nystagmic nystagmus by the closure of the eyes. As in other forms of ataxia, the knee-jerk is quickly lost. Failure of muscular power takes place as the disease progresses. The muscles of the head and neck as well as the arms become affected mostly with tremor, so that when a voluntary movement is attempted irregular jerky movements take place. Nystagmus is a common symptom. The progress of the disease is very slow. The lesion is the

cord consists of sclerosis of the posterior and lateral columns; the anterior column may also be affected.¹

**Anterior Polio-myelitis. Acute Atrophic Paralysis.
'Infantile Paralysis'**

Ætiology.—The disease, which is usually known by the name of 'infantile paralysis' occurs most frequently during early childhood; but, as a form of paralysis exactly similar occurs during the later years of childhood and also during adult life, the name certainly ought to be abandoned. It most frequently occurs during the first three years of life, at least four-fifths of the cases occurring at this period (Gowers). It is less frequent during the first six months than it is during the last half of the first year and during the second.

Very little is known as to its cause, and, while it occurs both in the strong and weakly, in the majority of cases in our experience it has been met with in typically healthy children, with a good family history, and who could not be said to do anything; and no reason could be assigned for its onset. It certainly appears to be commoner during the warm quarter of the year than at any other period. It appears occasionally to follow exposure to cold, such as sitting on damp grass, or it may apparently result from an injury. It is said to follow occasionally as a sequelæ of measles, scarlet fever, typhoid, pneumonia, acute diarrhoea. Dentition has been credited with being a cause, but of this there is not sufficient evidence. Perhaps the most likely exciting cause is over-exertion in children who have only recently learnt to use their legs, though this can hardly be a cause in children under a year old. The ætiology at present remains uncertain.

Symptoms.—The course of the disease may be conveniently divided into stages, and, following Gowers, they may be stated thus:

1. An initial stage, during which the paralysis occurs, usually accompanied by fever, and lasting a few hours to a week. 2. A stationary period, which lasts from a week to a month. 3. A period of 'regression,' during which the paralysis disappears in certain of the affected muscles, leaving others still paralysed; this stage usually occupies one to six months. 4. A chronic stage, during which atrophy occurs and deformities and contractures are developed. Some improvement may take place during this stage.

1. The initial stage is usually ushered in with fever, restlessness, convulsions, muscular twitchings, and cerebral disturbance. The severity of the attack differs much in different cases; it has rarely been closely observed, being usually attributed to dentition or gastric disorder, and only when the paroxysm has supervened has the importance of the attack been recognised. The pyrexia is rarely high, perhaps 101° to 102° ; there may be muscular twitchings of the face or the affected limbs; drowsiness, delirium, or convulsions may be present. The acute attack may be entirely absent, or, what is more likely, ill defined, so that it is overlooked by the friends; and the only history obtained is that the child was put to bed well, and that in the morning a limb or limbs were found powerless and limp. The paralysis is usually first noticed after the acuteness of the attack is passed, and in infants it is very

¹ See Gowers, *Diseases of the Nervous System*, vol. ii.; and J. S. Burry, *Review*, July 1886.

likely to be overlooked at first, or thought to be due to weakness only. The paralysis reaches its height at once, or at any rate in a few days or under a week. It is difficult to say what proportion of cases die in this stage, but probably the nature of the disease would not be recognised, and the attack would be attributed to 'convulsions,' or the early stage of some acute disease. Nevertheless, such cases have been recorded, and lesions found in the grey matter of the spinal-cord.

There seems to be no relation between the severity of the initial attack and the extent of the paralysis which follows it, some of the most extensive and severe paralyses being accompanied by hardly any febrile disturbance. It is not certain whether the febrile symptoms are due to the inflammatory lesion taking place in the cord, or the lesion in the cord as well as the fever and convulsions are the result of some unknown process going on in the body.

In some cases there is an acute attack, which passes away, leaving no definite paresis; another similar attack follows, and when that clears up a paralysis is noted. This was the case in the following instance. A boy, aged two years, a patient of Dr. Satchell of Stalybridge, was quite well and running about, when one day he was taken suddenly ill, crying, vomiting, and feverish; the following evening he was convulsed; he was put to bed and continued ill for two or three weeks with apparently severe brain trouble; his attack left him very weak; but he gradually recovered and was able to run about again. He continued well for two months, when the same symptoms returned; he cried with pain, there was vomiting and fever, followed with convulsions; he remained ill for fourteen days, and just as he was being got up and about again it was noticed that his right leg was paralysed. When ten two months after, there was wasting and paresis of the right buttock, thigh, and dorso-extensors of the foot.

2. After the paralysis has reached its fullest extent, a period during which the paresis of the muscles is stationary ensues, varying from two weeks to six weeks or two months. At this time the affected muscles are limp and powerless, so that the limbs or limbs hang quite useless and flaccid. In the more severe cases almost all the muscles in the body appear to be involved; the child cannot sit up, its head falls to one side through paresis of the muscles of the neck, its cry is weak or almost lost from weakness of the diaphragm and intercostals, its respiration is shallow and rigid, and its limbs relaxed and motionless. The paralysis may be confined to one limb or a group of muscles in a limb: thus an arm may hang useless by the side, and if raised above the head falls flail-like by the side. One or both legs may be powerless, and may be flexed, extended, or rotated without any resistance from the tones of the muscles. Hemiplegia is rare. The reflexes both superficial and deep are lost, so that tickling the sole of the foot or percussing the patellar tendon meets with no response. It is difficult to judge if there is any loss of sensation or at least sensory paralysis. In the most severe cases no sense of sensation is not as acute as usual: a spoon, which to a normal skin is unbearably hot, can be borne without eliciting any expression of pain on a recently paralysed foot, and in the same way a painfully severe application of faradism will be borne without flinching. It must be borne in mind, however, that the circulation in the skin is

interfered with by the lesion in the cord, and, moreover, it is much more difficult to test the sensations of an infant six or eight months old than it is those of an adult. The functions of the sphincters of the bladder and rectum are rarely interfered with.

The irritability of the muscles to the faradic current becomes lessened during the course of the first week or ten days, and is usually entirely lost in those muscles where a permanent paralysis has taken place, and thus the careful testing of the muscles may be of importance for prognosis. To the continuous current the muscle irritability is increasing during this period, though it gradually is lessened as the muscles waste, and may disappear during the atrophic period. The quality of the muscle irritability differs from normal, presenting the 'reactive of regeneration' due to the degeneration of the nerves to the affected muscles.

In the majority of cases one limb only is affected, and one group or groups of muscles more affected than others; in some few cases the paresis at first involves not only the limbs, but the diaphragm and intercostals. The most severe case coming under our notice was the following: A girl of nine months was quite well and healthy till June 20; she was able to raise herself up in her cradle, and could support herself with help on her feet. She was suddenly seized with convulsions in which her face and arms twitched; this was followed by a discharge from one ear, and at the same time she was completely prostrated, her voice was hardly audible, she lay in bed perfectly motionless except a rolling of the head from side to side. She was admitted to hospital on July 30, when the following notes were made by Dr. Kershaw: 'She is a well-nourished child; lies in bed quite helpless; the lower extremities are completely paralysed; there appears to be some loss of sensation, as only the application of the strongest faradic current appeared to cause pain. She can bear without crying the contact of a hot spoon, too hot to be held in one's own hand; can move right arm at the shoulder and elbow, but not the hand; the left arm is completely paralysed, though she seems to be able to move the fingers slightly. There is paresis of the intercostals, respiration mainly abdominal. No reactions to the strongest faradic current were obtained in the legs, some response could be obtained in the femors of the forearms. She died of pneumonia on August 7, forty-seven days after seizure.'

3. The stage of '*regeneration*' or improvement now commences, the improvement continuing for several months: many muscles being completely restored, while others become more and more flabby and atrophic. In rare instances all the paralytic muscles may recover. The child's health at this time is usually good, it is as bright and cheerful as usual, and there is apparently nothing amiss with it except its paralysis. The muscles, which are gaining in power, respond more readily to the interrupted current than at first, while the atrophic muscles fail entirely to react.

4. After some months improvement ceases, or, at least, any improvement which takes place six months after the onset is usually very slight indeed.

1. '*Reactive of degeneration*'—faradic irritability low; voltaic irritability almost is absent, so that closure-contraction occurs so readily, or more readily, with the ascending, or with the descending current; and contractions occur more readily when the circuit is broken than in the normal state.

The atrophy mostly goes on, and certain contractures, especially affecting the leg below the knee, leading to deformities, are apt to take place. At this period it is possible to make a forecast of the amount of paralysis which is likely to be permanent, and take stock, as it were, of the real damage which has taken place, which is probably much less than at first appeared likely. This permanent paralysis may affect a whole limb, though it rarely does this, some groups being entirely powerless, others only slightly weakened or not affected at all.

Sometimes the groups affected are associated together in their anatomy, as when the *affer* *area* type of Erb is present, the deltoid, spirati, biceps, and supinators being affected, while the muscles of the forearm, excepting the supinators, escape, the lesion in the cord being situated on a level with the fifth and sixth cervical roots. It is important to remember that the groups have no relation to their peripheral nerve supply, such as would be present if the paralysis was extra-spinal. Very often the muscles paralysed have no relation to one another, being picked out as it were at random.

In the *lower limb* the muscles below the knee usually suffer more complete paralysis than those of the thigh or buttock. The peronei usually suffer most, the result being that the heel is drawn up and the foot turned inwards (*talipes equinovarus*) by the unbalanced action of the gastrocnemius; so time goes on the contracted condition of the calf muscles, aided by the shortening of the leg, becomes permanent in consequence of a blood degeneration taking place, and the foot can no longer be drawn down. In the same way *talipes valgus* may be produced by paralysis of the tibial anticus, more rarely *talipes calcaneus* by the paralysis of the gastrocnemius. Both legs below the knee may be paralysed, both extended and flexed; and the patient cannot stand, but progresses by crawling on his hands and knees, dragging his wasted legs after him.

Of the thigh muscles, the rectus, vasti, and adductors are more often paralytic than the hamstrings, and thus flexion of the knee may result and become permanent. The gluteal muscles and rotators of the hip are often weak, so that the child in walking gives way at the hip.

In the *upper extremity* the muscles of the shoulder suffer most frequently, the deltoid being especially prone to attack; usually the supra- and infraspirati, biceps, triceps, and supinators are associated together; in such cases the shoulder droops from the weight of the arm, and the head of the humerus may slip readily out of its socket. The serratus magnus, pectoral muscles, and intercostals may also be affected. The forearm muscles, both extensors and flexors, together or singly, may be affected; less often those of the hand. Contractures are less often present in the arms than in the legs.

The muscles of the spine, sacro-lumbalis, &c., and those of the neck and diaphragm, are rarely permanently paralysed. Lordosis is present if the sacro-lumbalis is weakened. Lateral curvature may be present.

The paralysed muscles are always atrophied, though at times much subcutaneous fat may give a deceptive appearance of solidity to the muscle. In the most wasted muscles there is a complete loss of faradic irritability; there is usually more or less present in those only partially paralysed. The irritability to the continuous current gradually disappears as atrophy progresses, and in the wasted muscles becomes completely lost.

Arrest of development of the limbs which are paralysed also takes place; the bones appear to grow more slowly on the paralysed side. Other bones such as the ribs and pelvis may be affected. The joints often become more movable from relaxation and stretching of the ligaments, as well as from the loss of support afforded by the normal muscles; the articular ends may become deformed. The circulation through the skin of the paralysed limbs becomes slow, the surface has a blue or purplish appearance and feels cold to the touch. Chafings and sores are apt to form on the paralysed limbs and be slow to heal. The bones themselves frequently degenerate; in some cases little true bone may remain, fat taking the place of the osseous tissue. Injuries, operative or accidental, of such limbs are slow in healing; on the other hand, acute inflammations rarely attack the tissues.

Pathology.—There is an acute inflammation, the greatest stress of which falls on the anterior cornua of the grey matter in the cervical and lumbar enlargements. In severe cases the grey matter of the dorsal cord is also affected. There is strong reason to believe that, in severe cases at least, the inflammation is not confined to the anterior cornua, but involves more or less the whole cord; but the principal damage caused by the effusion of blood and inflammatory products occurs in the most vascular part of the cord, and this is in the anterior cornua where the large nerve cells are situated. During the acute stage of the attack, where there is perhaps a high temperature and convulsions, there is probably an inflammatory engorgement of the whole cord, possibly of the whole of the nervous centres; then an exudation of inflammatory material takes place which leads to both temporary and also permanent damage to the motor cells in the anterior cornua of the cervical or lumbar enlargements. During the next few months an absorption of inflammatory material and perhaps also repair of damage by the formation of new nerve fibres or cells goes on, while a certain amount of muscular power which has been lost is regained. Finally a sort of contraction or shrinking takes place, leaving a permanent paralysis of the muscles supplied by the nerve centres which have been destroyed.

Very few observations have been made on the cords of those dying during the acute attack or at the onset of the paralysis. In Drummond's case,¹ that of a child of five years who died in a few hours, the vessels supplying the anterior horns were distended with blood, the microscope showing massive extravasations of blood and changes in the nerve elements. A case recorded by Charlewood Turner, dying six weeks after the attack, showed softening of the anterior horns, spots where the grey matter had undergone complete degeneration, and an exudation of leucocytes had taken place from the vessels. In our own case, p. 541, similar changes were visible in the grey matter of the lumbar, cervical, and dorsal portions of the cord, and changes such as effusion of leucocytes from vessels were noted in the white matter, as well as the grey. Moreover, even in the medulla it was evident that an engorgement of the vessels had taken place.

Degenerative changes take place in the nerves which are connected with the damaged centres in the cord: the muscles also waste; their connective tissue becomes hypertrophied, so that in extreme cases very few muscular

fibres are left. The muscles which atrophise the paralysed muscles mostly also waste, their muscular fibres becoming replaced by connective tissue.

Diagnosis.—The diagnosis during the acute attack is always difficult, mostly impossible: the fever, delirium, and convulsions sometimes present naturally suggest some cerebral disease such as meningitis or the onset of scarlet fever or pneumonia. It is only when paralytic symptoms present themselves that the diagnosis is made; even then the paralysis may be overlooked, especially in young children, it being supposed that the child is simply weak as the result of the acute attack. When once the paralysis has set in, diagnosis is easy, though when paraplegia is present the distinction between transverse myelitis of the lumbal region and *polio-myelitis* may not be easy. In transverse myelitis there will be certainly loss of sensation; this is said not to occur in *cerbral myelitis*, though in the case recorded (p. 541) there was undoubted slight loss of sensation. In transverse myelitis of the dorsal region, its commonest seat, there will be no loss of *fundic irritability*, and after a few days or a week the reflexes will return and become excessive, and ankle-clonus can usually be obtained.

In *cerbral paralysis* there is no loss of *fundic irritability*, and no muscular wasting takes place.

Treatment.—The treatment of anterior *polio-myelitis* in the early stage is that of an acute inflammatory lesion of the cord. The child must be kept as quiet as possible in bed, given a milk diet, and good may possibly be done by applying mustard powders to the spine. If there is fever, nuxome and hooside of potassium may be given. When the acute stage has passed away, and the child is left in a prostrate condition, the greatest care must be taken to keep the child at rest as much as possible, all excitement of every kind being avoided. It must be borne in mind that, in patients dying, many weeks or even two or three months after the onset evidences of the inflammatory lesion may still be found in the cord, and during this period absorption of inflammatory material is going on, and the object to be aimed at in treatment is to secure the recovery of as much of the damaged cord as possible. A variable amount of nerve tissue has been certainly irreversibly damaged, but some of the damage done is recoverable, and, the more the general health is maintained and the child kept at rest, the more is it likely that recovery will take place.

It may be doubted if there are any medicines which have any direct influence over the nutrition of the cord or directly influence any morbid processes going on. Perhaps the most likely drugs to be of service are sedatives such as belladonna, and bromides in combination with iron or quinine.

The question of how soon should massage or electrical treatment be begun is an important one, for, on the one hand, the paralysed muscles are quickly wasting on account of their nerve centres being damaged, but on the other hand the disturbance of the child, the fright and excitement of the daily application of the battery, are not unlikely to do harm. The application of the battery current is hardly likely to modify or favourably influence the lesion in the cord, but it may help to maintain the nutrition of the muscles while recovery is taking place in the cord. On the whole we are inclined to believe that gentle rubbing or massage of the paralysed

limb or limbs may be practised from the first, and volitive currents may be used within a month or six weeks. It is wise to begin with a very weak current, at first using large wetted sponges as electrodes, and frequently interrupting the current, which after a few applications should be just strong enough to secure a contraction. The application should be made daily for many months, especial care being taken to select the paralysed muscles in the limb.

An important part of the treatment is to encourage the patient to exert as much voluntary power as possible, and he should constantly try to use the weakened limb. We believe that systematic attempts to use the paretic muscles, combined with shaming of the limb, are more likely to promote recovery than any electrical applications. The circulation in the paralysed limb is certain to be slow and defective; friction of the skin, with kneading of the muscles, is certainly beneficial; while a well-selected series of movements attempted on the part of the patient, or carried out by an attendant, assists the stream of power in the muscles. These measures must in most cases be persevered in for many months, if not years, in the hope of improvement.

The paralysed limbs must be warmly clad and carefully protected from cold.

Much may be done in the chronic stage by means of mechanical devices such as the application of artificial muscles and splints to correct deformities and support the limb. Division of the tendo Achillis, plantar fascia, and other restraining structures is often required. For useless flail-like limbs the question of excision of joints to procure greater stability, or even of amputation, has to be considered. (See also chapter on Talipes.)

Peripheral Neuritis

We have already referred to the fact that a form of paralysis or paralysis may accompany or follow an attack of diphtheria. The poisons present in the blood give rise to a degeneration or neuritis of the terminal nerve fibres. While it is far more common after diphtheria than any other disease, it occurs also after influenza and some other zymotic diseases. Occasionally peripheral neuritis accompanies rheumatism and chorea, and we have also noted it when no history could be obtained of any disease preceding the paralysis. That it occurs in connection with influenza we feel sure; in one case coming under our notice paresthesia of the ulnar muscles occurred in a boy aged seven years during convalescence from influenza, and where diphtheria could be excluded with certainty. In another case of ours of pneumonia which appeared to be due to influenza, paresis of the intercostals, diaphragm, and extremities supervened during convalescence, which ended fatally.

Myopathies

1. **Pseudo-hypertrophic Paralysis.**—Very little is known about the etiology of this particular disease. It is apt to run in families, and, strange to say, while it affects boys far more frequently than girls, in some families it affects the boys only, and in others it affects the girls. In

some cases there is a family history of the disease, and it appears it may be transmitted through the female side without the women themselves being affected (Gowers). In one of our own cases the patient's mother was an epileptic, but it rarely happens that any family tendency to nervous disease exists.



FIG. 150.—A case of *Spastic Paraplegia*. Emphasis on a boy of ten years, showing *scissoring* and *spastic paraplegia*.

Symptoms.—In the majority of cases symptoms first make their appearance during the second or third year, the child being late in learning to walk, the parents attributing this to backwardness or weakness. In some cases the symptoms of weakness are noted after the child has been walking some time, perhaps as late as the sixth or seventh year. The early symptoms are those of weakness in the legs. As Gowers well puts it, "these children usually walk late, often also walk clumsily, fall with ease, and rise with difficulty." If placed upon the ground they either cannot get up without help, or, what is more likely is the case, when they are obliged to use their hands in rising, pushing themselves off the ground and catching hold of chairs or table-legs to help themselves up. They walk clumsily, with a swaying gait, are quickly tired, and have to be wheeled about in a perambulator long after children of a corresponding age are running about and young walks.

In other cases the friends pay little heed to the backwardness in walking, but are struck with the size of the calves or perhaps against looseness of the child. At four or five years of age, often earlier, the muscular hypertrophy is conspicuous. The muscles of the calf are strikingly enlarged, firm, and hard; as are usually also the glutei and lumbar muscles—less often the hamstrings, extensors of the knee, and dorsiflexors of the foot. Of the other muscles, the *infra-spinatus* is next in the calf, the most frequently enlarged, and, as Gowers points out, this enlargement of the *infra-spinatus* may be of diagnostic importance. The *deltoidei* and *supra-spinatus* are often enlarged, the *latissimus* is mostly wasted, and the rule is that the other muscles of the upper extremity are wasted rather than hypertrophied.

In rare cases the masseters and muscles of the tongue are enlarged.

The muscles, whether enlarged or wasted, are weak, and it is this weakness of certain muscles which gives rise to the characteristic movements of the child. The *scissoring* gait is the result of weakness of the glutei

median and extensors of the hip generally. The difficulty in rising from the floor is due to the paresis of the extensors of the knees in the first part of the act, and the extensors of the hips in the second, the patient assisting the extension of the hips by placing his hands on his knees, and "climbing up himself" by grasping his thighs alternately with his hands.

Later in the disease the enlarged muscles contract, the earliest to shorten being the calf muscles, so that a talipes equinus is produced. Later on, the knee and elbow may become flexed.

The weakness of the extensors of the hip produces a certain amount of lordosis or curvature of the spine with the concavity backwards, the patient assuming this position in order to maintain his balance. (See Figs. 119, 121.)

In the last stages the patient becomes entirely bedridden and helpless, partly on account of the paresis of the muscles, partly also in consequence of the muscular contractions producing talipes equinus. In this stage the enlarged muscles mostly waste, and consequently lessen in size. The electric irritability of the muscles is unaffected both to the continuous and interrupted current at first; later, as the muscular fiber wastes, it gradually disappears. The knee-reflex, at first normal, gradually disappears for a similar reason. In children suffering from this disease the mind is often weak.

The progress of the disease is slow, extending over many years, the patient possibly being helpless and bedridden, having almost lost the use of his legs. He is even unable to sit up on account of the wasting of the spinal muscles, but is usually able to use his hands to the last. Death is apt to take place from bronchitis; this was the case in one of our own cases who lived to the age of twelve years, the disease having existed at least eight years. In the majority of cases where the disease begins early, death takes place soon after puberty, at any rate among the hospital patient class; under the most favorable circumstances, where great care is taken of the patient, life may be prolonged to a greater age. The course of the disease appears to be slower in girls than boys.

Diagnosis.—This is most difficult in young children in the early stages, and in the absence of typical enlargement of the calf muscles and infrapatelli. A fat, yet weakly, child of three or four years of age, who is late in



FIG. 121.—Standing at five years, showing Hyper-lordosis behind and talipes equinus.

walking and more or less rigidity, may somewhat simulate a case of pseudo-hypertrophic paralysis in its gait, and in the difficulty of getting up. Usually there is sufficient enlargement and hardness about the gastrocnemii to make the diagnosis tolerably clear, especially if there is corresponding enlargement of the infra-gliques and wasting of the latissimus dorsi. In the absence of muscular enlargement, especially if there is wasting, the disease may be confounded with disrophic muscular atrophy; but the latter disease is rare before puberty, is apt to affect the face and hands, and to avoid the calf muscles. A fragment of muscle may be obtained, and muscular atrophy can be excluded, if there is an excess of fibrous and fatty tissue present.

Prognosis.—The cases slowly, but surely, get worse; the weakness goes by year increases, though a certain amount of temporary improvement may take place. We have seen cases which we believe to have been examples of this disease in a mild form get entirely well.

Pathology.—The disease has been conclusively proved by the careful examinations of Gowers and others to be primarily a disease of the muscles, and if changes take place in the spinal cord they are only secondary. There is an overgrowth of connective and fatty tissue; it is the latter which forms the enlargement of the muscles, and it is the absence of muscular fibres which renders them weak. The shortening which takes place is due to the contraction of the fibrous tissue.

Treatment.—Medicines, except those which are likely to improve the general health, are of little use. The treatment which has proved itself of the greatest use in checking the progress of the muscular wasting is exercise of the affected muscles by well-arranged movements, which the patient is encouraged to perform, and flexions, with passive movements, so as to prevent shortening of the muscles. We have certainly seen cases which have been admitted to hospital improve to no inconsiderable degree under this treatment. It is needless to say it must be systematic, and carried out with the greatest patience if it is to be successful.

2. **Juvenile Form of Muscle Atrophy (Erb).**—This form of muscle atrophy resembles in some respects pseudo-hypertrophy of muscles, and some cases occur in which it may be difficult to say to which class they belong. We note here also the tendency to run in families. There is weakness and wasting of certain groups of muscles. The upper-arm muscles are usually first affected—namely, the biceps, triceps, and supinator longus; the lower part of the pectoralis major and minor, and also the serratus, trapezius, latissimus and rhomboids often also suffer more or less atrophy. The deltoids, infra and supra spinatus, usually escape; in some cases they have been described as hypertrophic. The muscles of the forearm and hand usually escape. In the legs, the quadriceps, the flexors of the leg, and glutei, the peronei and tibialis anticus may be affected. The muscles of the thigh, especially the sacro-lumbalis, may be wasted more or less. The electric irritability of the muscles is lessened in proportion to the wasting. There is no reaction of degeneration. The disease is essentially chronic.

3. **Infantile Muscle Atrophy of the Face Muscles (Landouzy Dejérine).**—This form is closely related to (2), if not actually belonging to the same class. This disease appears to be almost entirely observed in children. There is wasting of the muscles of the face, especially the orbicularis oris,

zygomatics, and frontalis. The expression of face is peculiar, and there is a curious alteration of expression if the child laughs or smiles, on account of the paralysis of the zygomatics which elevate the angles of the mouth. On account of the weakness of the orbicularis oris, the lips are separated and the lower lip protrudes. The tongue, eyeball-muscles, and muscles of mastication escape. The course, like that of other diseases of this group, is chronic and progressive.

Myotonic. Thomson's Disease

The first symptoms of this rare disease are first observed during childhood, and apparently persist through life. The disease is apt to affect several members of the same family, and can be traced back through several generations. The characteristic symptom is that whenever the patient attempts to move, the muscles assume a condition of cramp or tetanic spasm. After a few attempts to use his limbs the patient succeeds in gaining command of the muscles, and the spasm does not return till after a period of rest. No treatment appears to be of any use.

CHAPTER XXIV

DISEASES OF THE GENITO-URINARY SYSTEM

Congenital Anomalies of the Kidneys.—The principal malformations of the kidneys found *post mortem* are: (1) Absence, or only a trace, of one kidney, with hypertrophy of the other; (2) 'Horse-shoe' kidney, in which the two kidneys are united by a bridge of kidney tissue, giving the organ a horse-shoe shape. The kidney is placed with its convexity downwards, the ureter passing down behind the bridge. (3) The kidneys are frequently found *lobulated*, the surface being deeply fissured, dividing them into 'lobes,' as in the fetal state. (4) The kidneys may be *displaced* or more or less movable.

These abnormalities, though of extreme importance as references to operations on the kidneys and the diagnosis of abdominal tumours, need not be further referred to here. Obliteration of one ureter, partial or complete, may give rise to hydronephrosis and require operation, as in a case reported by Tuckwell and Symonds of Oxford.¹ Incontinence of urine from an abnormal opening of the ureter just in front of the meatus urinarius has also been met with.²

Addison's Disease. Tuberculosis of the Adrenals.—Addison's disease occurs occasionally in boys after puberty; it is very rare before this epoch. Dr. Eyo Smith has recorded a case in a boy of fourteen years, and Monti has collected eleven cases in children from three to fourteen years of age. Tubercles, both caseous and grey, are frequently present in the suprarenal capsules of children dying from general tuberculosis, without any symptoms occurring during life.

Hæmaturia.—Blood is present in the urine in a variety of conditions, in general diseases as well as in local, and a difficulty may not infrequently be experienced in determining the source from which the bleeding takes place.

Hæmaturia or hæmoglobinuria occurs at times in infants a few days or weeks old, who are also jaundiced; epidemics of such cases have been described by Wischel and Engelow as occurring in lying-in hospitals (p. 28). Two fatal cases, in which hæmoglobinuria was present in infants four months and eight months old respectively, have been described by Hirschsprung.³ In both cases the symptoms appeared suddenly; there was cyanosis, dark albuminous urine and feverishness; in one of the cases there was dyspnoea

¹ *Lancet*, vol. ii, 1882, p. 141.

² *Medicine*, American Edition, *Nov.*, July 1884.

³ *Congress international pédiatrique des Nations Médecines*, 1884, section de Pédiatrie.

(urine) and tetany of the hands and feet. The *post-mortem* showed that all the organs were of a dirty brown colour, and the blood in the body had undergone a remarkable change. Similar cases have occurred from poisonous doses of chlorate of potash, but neither of these cases had been taking this salt.

Hæmaturia occurs occasionally in wasted infants and young children from thrombosis of one of the renal veins, a consequent hæmorrhagic infiltration of the kidney taking place.

We should say the commonest cause of hæmaturia in infants and children under two years of age is the scorbutic condition described in connection with rickets (p. 400). In some cases hæmaturia is the first symptom, usually spongy gums are present, but periodical tenderness may be absent. Hæmaturia may succeed the tenderness and immobility of the limbs. The urine is generally pallid and is more or less markedly tickety. The nurse probably notices that the urine stains the napkin it may be bright red, or in other cases a yellowish-red colour. If the urine is passed into a vessel a red sediment of blood coagulates settles to the bottom, leaving the fluid portion tolerably clear.

We can call to mind several instances where infants suffering from hæmaturia from this cause were starved for stone; it is needless to say that no stone was found, and they quickly got well when their diet was changed. It is uncertain whether the blood comes from the kidneys or bladder. In these cases there is no sepsis, only a passive oozing of blood.

Hæmaturia may be the first symptom of **hæmophilia**, and in any case where the diagnosis is doubtful the family history should be required (see the similar notes).

Hæmaturia is often associated with purpura and may occur in acute cases of variola, diphtheria, or typhus, resulting from the rapid blood change which takes place.

Hæmaturia may be present in acute nephritis; in this case the urine is usually of a smoky tint, or more the colour of port, but in some cases the colour may be bright red from the large amount of blood which it contains. We have seen hæmorrhagic nephritis following scarlet fever, diphtheria, and pneumonia. A macroscopical examination of the deposit which falls to the bottom of the glass after the urine has stood for a while will show blood and epithelial casts in cases of nephritis.

Blood in the urine also occurs in cases of renal or vesical calculus, more rarely in tubercular kidney, sarcoma of the kidney, and vascular growths in the ureters or bladder.

Poisoning by chloride of potash, cantharides, or turpentine as a cause of hæmaturia must not be forgotten.

Treatment.—The treatment necessarily depends upon the cause, and the history of the case, and other symptoms apart from hæmaturia, must be carefully considered. It is important to exclude stone in the bladder as the cause of hæmaturia, and in all cases where the cause of the blood in the urine is doubtful it is wise to explore the bladder with a sound. Hæmaturia may be the only symptom of the presence of a stone. In hæmaturia depending upon an impoverished condition of blood the most important part of the treatment consists in improving the condition of the general health. Meat

juice, orange or lemon juice, with dialysed iron or the perchloride, may be given.

Styptics may also be given, though we have frequently been disappointed with their action. Of these, ex. hamamelis liq. (U.S.P.), in 3-5 minims doses, may be given every four hours, and continued for some days. Gallic acid 4-2 grains, with aromatic sulphuric acid, is sometimes efficacious when hamamelis fails. Spirits of turpentine 1-3 minims in mucilage, or liquid extract of ergot 2-10 minims may be used.

Acute pyelitis is certainly not a common disease in infants or children. We have, however, seen several cases of acute illness in infants or young children accompanied by a high temperature of an intermittent type; and after the attack has lasted several days it has been noted that the urine contained pus: the same having called attention to the fact that there was something unusual in the way in which the urine stained the diapers. Dr. J. L. Gee¹ has recorded a similar case in an infant 4 nine months. Dr. Emmet Holt² records three such cases in infants of eight months, nine months, and fourteen months respectively. The temperature in one of his cases ran high, and there were distinct 'chills' in which the infant became blue.

What is the exact nature of these cases, and whether the pyelitis is primary or secondary to some other disease, it is difficult to say. All the recorded cases ended in recovery.

Lithæmia.—Infants and children frequently pass uric acid in their urine, the uric acid being seen as a sandy deposit in the chamber vessel. The cause of this is mostly uncertain. Large quantities are often passed during convalescence from scarlet fever, not infrequently in cases followed by nephritis.

We have sometimes seen cases in which uric acid has been passed in large quantities: in one case coming under our notice the urine would be clear for a while, and then, especially after rough treatments, as itumping or riding a pony, urine thick with uric acid crystals would be passed. Uric acid is sometimes passed more copiously with the urine mixed with a stool giving at first the impression that the uric acid has come from the bowel, when apparently the staining at stool has caused the dislodgment of uric acid deposited in the bladder or pelvis of the kidney. In lithæmia a restricted diet should be given, and citrate of potash and linix may be prescribed.

Tumours of the Kidneys.—Swellings which occur in the region of one of the kidneys may be due to one of the following causes:

(1) New growth. (2) Tubercular or other abscess in the kidney. (3) Hydro-nephrosis. (4) Paraneuritic abscess.

(1) **Renal New Growths.**—In the majority of cases a new growth involving a kidney is a round-celled sarcoma which begins outside the kidney gradually displacing and compressing the kidney itself. It is difficult to say exactly where these growths begin—possibly in lymphatic tissue. In the majority of cases the new growth appears to begin in the kidney itself—at least no trace of the kidney can be found *post mortem*, but traces of kidney structure may be found scattered through the tumour on microscopic examination.

¹ Brit. Med. Jour. November 17, 1883. ² A. Cases for Pediatrics. November 1883.

In some cases the tumour is a myo-sarcoma, or in other words it is a round-celled sarcoma with a variable quantity of striated muscular tissue and spindle-shaped cells. In rare cases the growth consists of alveoli lined with columnar epithelium, similar in structure to the cylindrical epithelial sarcomas found in the large intestine. It is difficult to say where such tumours begin when occurring primarily in the kidney: possibly in the mesoderm of the Wolffian body.

Renal sarcomata are usually soft in consistence, resembling brain substance, and frequently contain masses of blood clot and altered blood in consequence of hemorrhages which take place into their substance. They often attain to great size, weighing many pounds, and by their enlargement displace the other organs of the abdominal cavity. The liver or spleen is pushed upwards, the small intestines are pushed on one side or posteriorly; the large intestine, where it crosses the tumour, is compressed against the abdominal wall (see fig. 115). The tumour may set up a certain amount of chronic peritonitis and contract adhesions to the intestines and other viscera.

Renal sarcomata occur most commonly in children under six years; of fifty cases collected by Seibert, forty occurred during the first five years of life, twelve being in infants under a year old. In a case recorded by A. Jacobi a sarcoma was present in the kidney of a fetus born dead, and other cases (Sir William Roberts and Lloyd Roberts) have been recorded in which the tumours were present at birth.

F. T. Paul,* of Liverpool, whose paper on this subject is the most important of those recently published, says, 'The chief characteristics of congenital renal carcinoma are these:—

- (1) They show themselves during the first five years of life, and are probably invariably of congenital origin.
- (2) They are primarily extra-renal though usually intracapsular.'

He points out that they may be bilateral, that they cause death by exhaustion or pressure rather than by urinary lesions, that metastatic growths only occasionally occur, but all forms of growth tend to recur after removal. The tumours frequently contain striped muscle, embryonic renal tissue, and various forms of adult connective tissue. The complexity of the structure of



FIG. 115.—Cylindrical Epithelioma of Kidney in a girl of nine years. Dr. Watson's case.

* *Liverpool Med. & Chir. Soc.* January 1894.

these growths is to be explained by the inclusion within the capsule which forms round the embryonic kidney of elements of other neighbouring tissue. Mr. Paul describes growths of the 'simple connective tissue type,' of the 'complex connective tissue type,' and of the 'retal adenoma type.'

Except Albee's recent casts almost all the subjects of these tumours have died within a year of operation.

Symptoms and Course.—In the majority of cases enlargement of the abscess due to the new growth encroaching on the other abdominal organs is the first symptom to call the attention of the friends to the case. In the minority of cases (one fifth, Seibert) hæmaturia is the first symptom occurring at a variable period before the discovery of a tumour. The swelling is first noted occupying the right or left lumbar region, between the ribs and the crest of the ilium; it has a rounded outline, which can be traced downwards, but not into the pelvis, and upwards behind the liver or spleen. On palpation it can be separated from the liver or spleen. It moves less freely with respiratory movements than an hepatic or splenic tumour does. Percussion shows that the large bowel lies across superficially first, but if the tumour is large the colon may be compressed and no tympanitic note will then be detected. The swelling has a soft semi-fluctuating feel, and on exploration with a subcutaneous syringe pure blood is withdrawn. During the early stages the patient appears perfectly well, is well nourished, complains of no pain; there is no tenderness on handling the tumour. Especially pain is complained of; in some cases it is acute and due to accompanying peritonitis. In Seibert's collection of fifty cases hæmaturia was present in tumour at some time or other during the course. Vomiting is an occasional symptom. As the tumour increases in size it distends the abdominal walls, the skin becomes smooth and shiny and is marked with large dilated veins. The tumour pushes up the diaphragm, passes perhaps beyond the middle line in front, and extends backward to the spine behind, sometimes, as in the case fig. 112, forming an enormous abdominal tumour. The liver and spleen are frequently enlarged; the patient gradually emaciates and has a cachectic appearance; perhaps the lower limbs become oedematous from pressure on the vena cava, and death comes perhaps after many weeks of lingering misery. Constipation is often present from pressure on the colon.

Diagnosis.—A sarcomatous enlargement of the kidney may be possibly mistaken for a hydro-nephrosis, abscess of the kidney, perinephritis, or spinal or other abscess. It is least likely to be mistaken for a tumour of the liver or spleen. A renal tumour may be distinguished from an *hepatic* or *splenic* tumour by the fact that it moves less with respiration and the colon traverses its anterior surface, and moreover the edge of the liver and spleen may usually be felt. A congenital *hydro-nephrosis*, in which the distension is the most complete, may cause some difficulty in diagnosis; there would be, however, in a swelling of any size, fluctuation transmitted from the abdomen to the flank in a hydro-nephrosis, and on exploratory puncture the fluid withdrawn would make the diagnosis clear. An abscess or, occasionally, enlargement of the kidney is rare without a history of pain and tenderness in the lumbar region, and without pus in the urine. It is, however, possible that these may be absent, and then the rapid growth in the case of a sarcomatous

kidney would in time decide the diagnosis. But a difficulty could rarely occur.

Prognosis.—This is necessarily grave; though such tumours are chronic in their course and the patient may live for many months or even a year after the discovery of the tumour.

Treatment.—As far as we know, no drug influences the progress of the growth. Removal of a sarcomatous kidney is usually followed so rapidly by recurrence that thus, the only possible treatment is hardly justifiable.



FIG. 112.—Congenital Renal Sarcoma, from a photograph. (H. F. Paul.)

Tuberculous Kidney.—Tuberculosis of the kidney is very commonly met with in children as part of a general tuberculosis. Thus of two fatal cases of tuberculosis in the Children's Hospital in the years 1884-1885 inclusive, in forty-six there was evidence of tubercle in the kidneys in larger or smaller amount. Most frequently the lesions are simply scattered grey tubercles in the substance or on the cortex of the organ; this was the case in thirty-nine instances.

Much more rarely large masses of tuberculous material are found, or occasionally extensive destruction of the papillæ and ulceration of the pelvis, and sometimes of the ureter. Occasionally calculi are found coexisting with tuberculous lesions.

It is now rare to find children suffering from tuberculous kidney apart from a general tuberculosis; less than half a dozen such cases were admitted to the hospital in the five years above mentioned, and genito-urinary tuberculosis—i.e. lesions affecting the kidneys, bladder, testes, prostate, vesiculae seminales—is not nearly so common as in adult life, though the bladder is not rarely involved. When the tuberculous lesions of the kidney are only part of a general tuberculosis, life is usually destroyed before the kidney affection is very far advanced, but where the disease is limited to the urinary tract the whole of one kidney may be destroyed and converted into a mass of hard, bony tissue with hardly a trace of remaining structure left. Very commonly both kidneys are affected together, but in a considerable proportion of

cases one organ alone is attacked, and under such circumstances life may be prolonged, or even recovery may take place, the damaged kidney shrinking, and ceasing to cause irritation: the whole of the work then devolves upon the fellow. All stages of disease, from the presence of a few tubercles to that of cheesy masses, and on to complete disorganisation, may be found. Perinephritic abscesses develop in some cases.

Symptoms.—When the kidneys are the seat of milky tubercles there are usually no symptoms whatever pointing to disease of those organs: thus of thirty-nine cases of this form of disease, in only one was there even albuminuria, and that to a very slight degree. When, however, tuberculous ulcers or abscesses exist, pus, mucus, and large quantities of albumen may be found: but the only instance in which hæmaturia existed is the forty-six cases of tuberculous kidney we have examined was one in which calculi coexisted with the tubercle, and undoubtedly the presence of blood in the urine points to calculi rather than to renal tuberculous.

Pain and tenderness are only prominent symptoms when there is extensive disease and the pelvis becomes distended with pus and tuberculous material, and the same statement holds good of enlargement: it is only in the later stages of the disease that any palpable enlargement of the kidney takes place.

Frequent micturition is rather a symptom of tubercular cystitis than of renal disease, and where it occurs with evidence of tuberculous of the kidney, especially if there is tenderness of the bladder and much pain on voiding, or passing a catheter, it is tolerably certain that the bladder is affected as well as the kidney.

The presence of tubercle bacilli in the urine would, of course, indicate urinary tuberculous, though without other evidence it would not show whether the disease was renal or not: unfortunately in most cases of renal tuberculous the bacilli are not to be found until the disease is far advanced.

When one kidney alone is affected and the ureter becomes blocked with caseous material or granulations, pyrexia may develop and form a large abdominal tumour in which fluctuation may be detected: in such cases more or less fever will also be present and the diagnosis will be easy. It is in the early stages that a doubt arises. If there is a tubercular history or evidence of tubercle elsewhere, if the trouble is of only a few months' duration and there is pus, but little or no blood, in the urine, and if there is a gradual failure of health, the disease is probably renal tuberculous.

Treatment.—In cases of milky tubercle nothing, of course, can be done for the renal affection. Where pyelitis exists medicine can do something: the urine should be kept sterilising by the use of diluents and bicarbonate (two- or three-grain doses in half an ounce of peppermint water); alkalies such as carbonate of potash or liquor potassæ, or the citrate of potash with hypocyvams, will also be found useful. If there is lumbar pain and tenderness with palpable enlargement of the kidney, and the symptoms do not subside under medicinal treatment, nephrotomy by the lumbar incision should be performed and the kidney drained. If on exploration the kidney is found entirely disorganised, and there is evidence from the amount and quality of the urine that the other kidney is sound and efficient, a trial should be given to simple drain-

age; but, should the discharge not decrease, and should the health be failing, removal of the affected kidney is called for. This, however, clearly can only be justifiable if the other organ is working well, and if the bladder or ureters are affected nephrectomy would be probably useless. If removal of the kidney is decided upon, it should be done before the health is too much broken down, and the lumbar operation should be the one selected. We have only once met with a case in a child calling for either nephrectomy or nephrectomy, so that we do not think suitable cases can be common.

Hydronephrosis is not very rarely met with in children, and may be congenital or the result of partial blocking of the ureter by a calculus or stricture. Complete obstruction of the ureter appears to lead usually to atrophy of the kidney rather than to hydronephrosis.

The dilated kidney forms a tumour which has characters like those of the solid renal growths, except that fluctuation may be felt in it. The history is, however, often of longer duration than is the case in solid masses, which usually prove fatal in less than eighteen months. Occasionally the fluid of a hydronephrosis is discharged by the ureter, in which case the swelling will, of course, vary in size.

Treatment.—Hydronephrosis should be treated by incision, which is best performed in the lumbar region. The fluid which escapes has usually the characters of clear dilute urine. The kidney should be drained for some time, and only after failure of this treatment should nephrectomy be thought of.

Renal Calculus.—Stone in the kidney is, like stone in the bladder, a disease much more commonly met with in some localities than in others; it is, however, apparently relatively rare in children, and when it does occur it is seldom that the symptoms are as severe or characteristic as they are in the case of adults. It appears that the majority of calculi formed in the kidney is children pass down to the bladder without giving rise to any severe symptoms of renal colic. Should, however, a stone form in the kidney and be retained there, it may give rise to pain, local and radiating, pyuria, frequent micturition, tenderness on pressure over the kidney, with rigidity of the lumbar muscles, retraction of the testis, vomiting, and above all to hæmaturia: this last is the most characteristic symptom of calculus, and in the absence of nephritis renal hæmaturia is probably due to calculus, though occasionally intermittent hæmaturia is met with without there being any proof of the presence of a stone. We have only on two occasions had to perform nephrolithotomy in children. Both recovered satisfactorily from the operation.

In a few cases, if the disease goes on, pyo-nephrosis may be set up, and the kidney will then form a tumour perceptible to the touch.

Treatment.—Should medicinal treatment, which is the same as that for tubercular nephritis, fail to give relief, the kidney should be exposed by the lumbar incision and explored by puncture with a needle; if the calculus is struck, a director is passed along the needle, and the kidney opened along its convex surface and the calculus removed. If the needle fails to find the stone, the kidney should be carefully explored with the finger, both by palpation upon the surface and subsequently by opening the pelvis and examination with the finger and with sondes. Any calculus found should

be removed and a drainage tube passed up to the surface of the kidney. The wound is then treated on ordinary principles, the tube being gradually shortened. If the kidney is healthy and the ureter patent, the wound will probably speedily close entirely; if, however, the ureter is blocked, or there is much destruction of the kidney, discharge may go on indefinitely, and it may be necessary to remove the organ in order to obtain healing of the wound. Before nephrectomy is thought of, however, care must be taken to ascertain that the other kidney is capable of doing sufficient work. For farther details we must refer to the works of Hensli, Bruce Clarke, and Newman; also to papers by one of the present writers in the 'Medical Chronicle' for 1886-7-8-94.

Acute Nephritis.—Acute inflammation of the kidney occurs much less frequently as a primary than as a secondary disease. The kidney is fortunately not so prone to take on inflammation as the lungs, possibly because they are less exposed to cold and they are out of reach of the many organisms present in the air. They are, however, easily irritated by toxic substances present in the blood, and epithelial and other changes are readily induced in the course of various diseases such as scarlet fever, diphtheria, and in all kinds of septicæmia.

Acute nephritis does, however, occur as a primary disease, or, at any rate in patients who, as far as we can ascertain, have not suffered from any antecedent disease, and who were in perfect health up to the time of the attack. Thus we find a schoolboy who has never had scarlet fever and has been apparently well, has a shivering fit, voids albuminous and perhaps dark urine, and passes through a typical attack of acute nephritis indistinguishable from post-scarlatinal nephritis. In other cases the commencement of the attack is more insidious, and the course more subacute than acute. In rare cases acute nephritis occurs during infancy apparently as a primary disease; and it is needless to say that it may be readily overlooked, as the urine of infants is not often examined unless special attention is called to it on account of its staining the nappin. If there is associated broncho-pneumonia or gastro-intestinal disturbance, it is still more likely to be overlooked. The difficulty of diagnosis in such cases is not always overcome by a post-mortem examination, inasmuch as we may find pale kidneys with more or less marked parenchymatous changes in infants who have died of enteritis, septic pneumonia, and other acute diseases. It is by no means easy always to say when sections of kidney are examined macroscopically, whether such changes as desquamation of the epithelium are pathological or accidental, or whether there is slight proliferation of the epithelium or not. We must emphasize the importance of examining the urine in all cases of serious illness in infants accompanied by fever, especially if no cause for the illness can be found. At the same time we deprecate the too frequent use of the catheter for the purpose, as urethritis or cystitis is readily set up.

Reference has already been made to acute nephritis (p. 354) when speaking of scarlet fever, as acute nephritis occurs more frequently during convalescence from this fever than after any other disease. It is well to bear in mind, however, that nephritis may occur after some other febrile states, such as diphtheria, variella, typhoid fever, vaccinia and eczema. These febrile conditions appear to leave behind an irritable kidney which is liable to take

on an acute inflammatory state. It must not be forgotten that nephritis may follow mild attacks of scarlet fever; the primary fever may have been overlooked by the friends, especially if the latter are unobservant to signs; and in any patient coming under notice for the first time, suffering from acute nephritis, the history of the case should be carefully inquired into and the child's skin examined for any traces of desquamation.

Acute nephritis occurring during convalescence from scarlet fever, or as a primary disease, is usually an inflammatory lesion of the corpuscle pyramidal type. There is an inflammatory engorgement of the blood-vessels, and, as a result, a choking of the vessels by the exudation of liquor sanguinis, and usually of blood corpuscles. As a consequence of this the urine is scanty and contains fibrinous casts, blood corpuscles, albumen, and much epithelial debris. In the less acute cases there is not sufficient blood present to discolour the urine. If the inflammatory condition fails to be relieved, secondary changes occur, the most important of which consist in a glomerular or periglomerular nephritis. The glomeruli become enlarged in consequence of a hyperplasia of their endothelial nuclei (Friedländer), or in other cases a fibro-cellular growth takes place between the glomerulus and the capsule of Bowman; in either case the result is the same—namely, an obstruction to the flow of blood through the glomerulus. Changes in the epithelium also take place. As these changes progress the urine becomes more and more scanty, and death takes place from either cardiac failure, uræmia, or some inflammation of a serous membrane.

The symptoms and treatment have already been discussed (pp. 265, 271), and little need be added here. It is well to bear in mind that cases of very different severity may be met with: in some cases the engorgement of the kidney is extreme, and variable quantities of urine are passed, containing large quantities of blood and albumen. In other cases there may be marked uræmia, much general oedema, scanty urine, with no albumen or only a trace, and we may be left in doubt if the case is really one of nephritis, or whether the oedema is simply due to a watery state of the blood. This class of case is not uncommon in young children under three years who have recently suffered from some acute disease, such as acute diarrhoea or pneumonia; the pallor and oedema present suggest acute nephritis, but an examination of the urine possibly gives negative results as far as albumen is concerned. In some of these cases we have failed to find any evidence of nephritis on a microscopical examination of the kidneys.

Septic Nephritis has been also referred to under the complications of scarlet fever (p. 264). It is well, however, to bear in mind that such cases occur after other febrile states. We have seen a condition of the kidneys answering this description occurring apparently primarily, but we have always had our suspicions that some cause must have been overlooked.

Acute Toxic Nephritis, Parenchymatous Nephritis.—In diphtheria, malignant endocarditis, cystic diarrhoea, and any disease in which there is poisonous poisoning, there is albuminuria, and certain changes in the kidney are found after death. This is especially so in diphtheria. We have already referred to the albuminuria which so frequently occurs in the course of this disease, and also to the fact that in some cases, especially in the malignant form, the urine becomes more and more loaded with albumen while becoming

more scanty, and complete anuria may take place twenty-four hours or forty-eight hours before death. Unlike scarlatinal nephritis there is rarely oedema, muscular twitchings, or anemic convulsions, but coma usually precedes death. On *post-mortem* examination of the kidneys of those dying from diphtheria, in most cases the kidneys will be found to be hyperemic and slightly enlarged, the cortex being pale, the medullary portions congested. The principal microscopical changes occur in the epithelial cells, which are swollen and granular. A few fibrin cylinders and blood cylinders are sometimes present. No very marked changes sufficient to account for complete anuria have been found in the kidneys of those dying with total suppression of urine. It is possible, as has been suggested, that the anuria is due to a peripheral neuritis of the abdominal sympathetic, or that portion of the system which regulates the local tension of blood in the capillaries of the kidneys.

Chronic Nephritis.—We cannot too strongly emphasise the necessity of examining the urine from time to time of children who have recently had scarlet fever, especially if they have suffered from scarlatinal nephritis. It is not enough to find that on one or two occasions the urine is free from albumen in order to declare them well. Nephritis, however mild, renders the kidneys liable to attacks, and these subsequent attacks may readily pass into a chronic nephritis in which organic changes take place and irretrievable damage is done. There may be an albuminuria which is intermittent, and in consequence a slight kidney affection is liable to be overlooked. We have known children who had suffered from nephritis and who were apparently quite well pass urine free from albumen during the night or when they were kept in bed, but albumen at once appeared in the urine when they got up, and especially if they went out of doors. In such cases an acute attack is readily set up, with attendant anuria and dropsy. The history of a chronic nephritis is the history of a series of acute or subacute attacks, followed by a period of apparent health perhaps extending over many years. No doubt in a certain proportion of cases recovery eventually takes place, but in others the kidneys become hopelessly damaged by fatty and fibroid changes, and they eventually succumb. In many of these cases the progress is exceedingly insidious; it is only when the friends have their attention called to the puffy face or oedema of the feet that medical advice is obtained.

In a typical case of subacute or chronic nephritis the appearance of the patient at once establishes the diagnosis—the bloated puffy, pallid face is characteristic. The abdomen is distended, being tympanic over the air-containing intestines and stomach, dull and fluctuating in the flanks from the presence of fluid. The scrota are oedematous, the skin everywhere pits on pressure, especially on the dorsum of the feet. There is frequently headache and vomiting or nausea. The pulse is usually slow and of high tension, but in children the high-tension pulse of Bright's disease is less marked than in adults. The heart cavities become dilated, the apex beat is diffused and tends to become displaced outwards beyond the left nipple line. Possibly the urine is scanty, contains many casts, and is loaded with albumen. Gradual improvement takes place till the patient is fairly well again, and the urine free, or nearly free, from albumen. In other cases they remain for months in practically the same condition, the amount of albumen

and dropsy varying from time to time. Gradually perhaps there is increasing dropsy, so that the patient becomes waterlogged. The face, lower extremities, and scrotum are extremely oedematous, and the peritoneal cavity distended with fluid, while the sickness is very distressing. Dyspnoea is usually a marked symptom, and the patient has to be propped up in bed. Finally the patient lapses into coma, which marks the beginning of the end. The urine is often reduced in amount to one or two ounces in twenty-four hours. Uremic convulsions are common at the last.

In such cases a 'large white kidney' is found *post mortem*; sometimes the kidneys are enormously enlarged. In one of our cases (a girl of twelve years) the two kidneys weighed together 2½ ounces, and one measured six inches in length. Such kidneys show the epithelium infiltrated with fatty drops, and various blood changes, especially around the glomeruli, many of the glomeruli having been strangulated by a surrounding fibroid growth.

The 'granular contracted kidney' is rare in children; we have seen but two cases, and these came under observation only a few days before death. Both occurred in girls, one aged 11½ years and the other 10½ years. In the former case there was only a history of two or three weeks' illness before admission to hospital, but the history was imperfect; she had never had scarlet fever; when admitted there was much oedema and dyspnoea; the urine was of sp. gr. 1013, containing half albumen—she passed 800–1000 cc. daily. At the *post-mortem* the right kidney weighed 2½ oz. and the left ½ oz. The left was a mere outline of a kidney; the capsule of the right was adherent, the surface granular, the cortex was narrow, and, in short, the kidney was an extreme example of a granular contracted one. The ureters were dilated.

The other case (girl 10½ years) was admitted to a surgical ward for ricketsy deformity of the tibia. There was a history for two years before of thirst, headache, and frequent passage of urine, especially at night. On admission there was urgent dyspnoea, for which no cause could be found; she gradually passed into an unconscious state, and died twenty-four hours after admission. No urine was obtained, she having passed it into bed. At the *post-mortem* the kidneys were typically granular and contracted; they together weighed 1½ oz. only, and measured two inches in length; the capsules were adherent, the surface granular, and the cortex surface wrinkled.

Treatment.—In chronic albuminuria the patient must be rigidly protected from cold, as the least chill is liable to lead to an acute attack. Bed is the best place as long as albumen is present in the urine. A simple nourishing diet is necessary, with forcing the staple food, with arrowroot, ground rice, or other light puddings. Meat is best avoided as long as the urine is albuminous. When oedema is present, and the urine scanty, hot air or vapour baths should be given daily, while the kidneys are acted on by diuretics, such as tartaric acid or potash, or by resin of cantharis, digitalis, or squills. During convalescence tr. ferri succatilis may be given with digitalis. Vomiting is best treated by saline purgatives and peptised milk given in small quantities (P. 301).

CHAPTER XXV

DISEASES OF THE GENITO-URINARY SYSTEM—continued

Stone in the Bladder in children is, as in adults, a much more common disease in some localities than in others. It may occur in any age, and a congenital case even has been recorded. The symptoms vary much in severity; sometimes but little pain or trouble is caused by the stone, at other times the distress is constant and severe. The variation of calculus need not be discussed: there is little evidence that any particular diet has any active share in producing it.

Symptoms.—There is usually pain referred to the end of the penis, or to the hypogastrium or perineum; the pain is most severe towards the end of micturition, but when there is cystitis is nearly constant. Passage of blood in the urine, usually at the end of micturition, is a very frequent though not absolutely constant sign; frequent micturition and inability to retain the urine are almost always present. The straining efforts to empty the bladder often give rise to prolapse of the rectum and hernia. An elongated, excoriated prepuce, the joint oozing of the irritating quality of the urine, of frequent micturition, and of pulling at the penis to relieve the irritation felt at the end of the organ, is usually seen. The urine is usually containing purulent phosphates in varying quantity: if no cystitis is present, it may, however, be quite clear. On sounding, the stone is usually felt at once: it is rare to find a stone in children that is not struck by the instrument as it enters the bladder, but, as this is not always so, if the other signs of stone are present, repeated soundings should be made if the calculus is not found at once.

E. Owen suggests that sometimes the stone may be lodged in the orifice of our ureters: but, though Dr. Cullingworth and others have recorded such cases in adults, we do not know of an instance of this in childhood.

The most common variety of calculus in children is the uric acid; now, perhaps, comes the form consisting of urates; if the stone has caused cystitis, there may of course be a phosphatic coating, or the whole calculus may be phosphatic. Ebersen believes that the uric acid urates of newly born children form the first stage in calculus production, and that the large quantity of uric acid present in fetal and early life explains the frequency of calculi of this substance (*Centralblatt f. Chirurg.* No. 14, 1884). The abnormal elimination of uric acid leads to degeneration of epithelium, which forms the animal basis of the calculus.

Calculi in children vary much in size: that is to say, that, as different calculi give rise to varying degrees of distress, some of them are allowed

to reach a larger size before the child is brought for treatment than in adults.

In shape the calculi are usually oval and flattened (see, *at id.*), but spindle-shaped stones are often met with: such are those which, while small, so frequently pass into the urethra, and, becoming impacted, give rise to retention of urine. Thus one of these small oat-shaped calculi some day comes to lie with one end projecting into the urethra; violent straining to pass urine takes place, and the calculus is washed along the urethra and usually becomes fixed just within the meatus at the fossa navicularis, since the meatus is the narrowest part of the urethra. In other cases the stone is arrested at the bulb or in the penile portion of the tube. The symptoms of such an occurrence are pain, tenderness of the part, retention of urine, and hæmaturia; on examination the stone can usually be felt through the urethral wall, or is readily struck on passing a sound or probe into the urethra. If the case is neglected, absorption may take place and extravasation of urine: this sometimes occurs very rapidly. We have met fatal extravasation come on in a few hours. When this occurs the symptoms are the same as in an adult: pain, swelling of the perineum, scrotum, and penis, constitutional disturbance, and, failing relief, rapid sloughing of the tissues. In all cases of retention of urine in a child, if phlebotomy will not account for the inability to empty the bladder, impacted calculus should be suspected. The secondary effects of calculus are cystitis, pyelitis, and suppurative nephritis. The ureters may become dilated and inflamed by extension of mischief from the bladder: and obstruction to the outflow of urine, suppurative pyelitis, and subsequent extension of suppuration along the renal tubes and in the peripelvic tissue may result. This is probably not always fatal, and on removal of the stone the kidney-mischief may subside; nevertheless the injury so done to the kidneys may be one of the reasons why children, the subjects of stone, seldom seem to grow up, though the mortality from lithotomy is so small in childhood: it is, as Mr. Erichsen says, very rare to see an adult who has been cut for stone in childhood.

Differential.—One or more of the symptoms of stone may be caused by many other conditions: worms, phlebotomy, a contracted meatus urinarius, simple or tubercular cystitis, the so-called irritable bladder,¹ vesical tumours, and renal calculus, all may simulate stone in the bladder to a certain extent; the diagnosis is only to be certainly made by sounding. Stones can often be felt by bimanual palpation, one finger being passed into the rectum and the other hand pressed down above the pubes.

Treatment.—Until recent times lateral lithotomy has been practically always the mode adopted for removal of a vesical calculus in boys, and its success is so great that but little attempt has until lately been made to find any other treatment. Median lithotomy is inde applicable, on account of the small size of the parts. Of late the operations of lithotomy and suprapubic lithotomy have both been employed in children. Keegan, in the "*Indian Medical Gazette*," May 1884 (vide also "*Lancet*," vol. ii. 1886 and 1890),² has collected over one hundred cases of lithotomy in children between

¹ Thus, for instance, hæmaturia may result from phlebotomy and consequent irritable bladder (Bryant), and also may be due to tubercular cystitis. See also p. 350.

² Also *Southey's Med. Chron.* vol. xii. 1860.

the ages of two and a half and eleven years; among these there were five deaths; in six cases the stone was allowed to escape with the urine after crushing, in the rest it was evacuated; the size of the calculi varied from five grains to four drams.

It is now well established, chiefly by the work of Keegan and Fryer in India, that the urethra of a child of three or four years will readily admit a No. 3 lithotrite after dilating the meatus, and we have found no difficulty whatever, as far as this goes, in the cases in which we have tried it: such an instrument is abundantly powerful for the vast majority of stones in fact in children, and there seems no valid reason against lithotomy on this ground. In one of our cases, however, the lithotrite broke in the child's bladder, and was removed, together with the stone, by suprapubic lithotomy. This child died of bronchitis shortly after. The death was clearly the result of the somewhat prolonged operation and exposure. Fryer even says that a No. 6 canula may be readily passed in a child under one year old, though this is not always the case. In our own cases there was some difficulty in passing the stone, but this was got over in one case by passing a finger into the rectum and lifting the stone between the blades of the lithotrite. The operation, in this instance, was followed by pyæmia, and the child died; after pyæmia had developed it was found that a second stone existed, and this, being lodged in the neck of the bladder, was removed by median lithotomy, but the pyæmia was in no way improved. We do not, however, base upon this case in any argument against lithotomy, though it must be remembered that the natives of India bear surgical operations far better than Europeans, provided no bone lesion is present. In our case kidneys and ureters were both diseased, and probably this condition largely contributed to the fatal result. Though the cases we have mentioned show that lithotomy in children is not without its difficulties and dangers, we have no doubt from our own experience that it is the proper operation to perform in cases where the stone is small or of moderate size, and the child is not too weakly to bear an often necessarily prolonged manipulation. In any case a well-demonstrated lithotrite is essential, as debris is apt to become jammed in the blades, and thus to prevent the withdrawal of the instrument without difficulty. We have had to open the urethra and protrude and clear the lithotrite before it could be withdrawn through the front part of the passage.

As to the suprapubic operation, there is much to be said both for and against it. Against it is the risk of wounding the peritonæum, the risk of urinary fistulation, and the fact of the good results following the lateral operation. In favour of it is the fact that the operation is done as it were in the open: there is no cutting in the dark, no risk of wounding important structures such as the rectum, pelvic fascia, and seminal ducts,¹ while injury to the peritonæum is only likely to occur exceptionally, and is less likely in children than in adults, from the fact that in children the bladder is subperitoneal, in adults a pelvic organ.

Suprapubic lithotomy in children has, as shown by Sir Wm. MacCombs and others, a very small mortality: it is an easy operation, and requires no

¹ Sir Wm. MacCombs quotes Hirschfeld as the effect of of eighteen males and of four females in 125 operations, and that fourteen of the males and only one of the females died. *Lancet*, March 29, 1887.

aided assistance. In performing the operation no rectal bag should be used; the bladder should be injected with from 3 to 4 oz. of bougie lotion and a gradual dissection made down on the organ, not using the knife along the perivesical tunica exposed. A staff should be kept in the bladder during the operation, and its end used as a guide upon which to open the bladder: by pushing the bladder up gently with the staff, and opening the vesical folds down, all risk of injury to the peritoneum is entirely avoided. As soon as the bladder is laid bare, two sutures are passed through it, and the organ is opened between them, the stone is extracted with forceps, or the finger, and the wound either left altogether open, or the bladder stitched up, the superficial structures being left quite open. Any stitches passed through the bladder walls should not include the mucous membrane. It is well to keep the child on its side or face after the operation, to allow free drainage away of any urine that may collect in the wound. In several cases (R. W. Parker and others) the wound has united by first intention, but, on the whole, we think it better to leave the rest of the wound open while the bladder wound is healed, or perhaps better still to use no sutures at all. The operation has largely replaced lateral lithotomy, but further experience is required. We have not done lateral lithotomy for several years, all cases of stone having been dealt with either by lithotomy or the suprapubic operation.

It is unnecessary here to describe the operation of lateral lithotomy; it will be sufficient to point out that the operation in children differs from that in adults chiefly in that in childhood the field of operation is smaller, not only on account of the size of the patient, but because the genital organs are undeveloped and the prostate seems only in a very rudimentary condition. It is usually said that in children the difficulty of the operation is in getting into the bladder, in adults it is in getting the stone out. This arises partly from the small size of the parts already mentioned, partly from the fact that the bladder in children is more an abdominal than a pelvic organ, and partly because the diameters of the child are more easily increased than those of the adult, and very gentle manipulation is therefore required. In lateral lithotomy in a child the incision is usually carried through the whole depth of the prostate, instead of only through a part of the gland, and unless the opening into the bladder is fairly free there is a risk of pushing the bladder before the finger and stripping it up from its attachments, or even of tearing across the urethra. The only other point requiring remark is that in children it is often easy by passing a finger into the rectum to bring the stone within the grasp of the forceps, or even to estimate it from the perivesical opening, and this is still further facilitated in some instances by pressure with the hand on the abdomen. In one case we could easily grasp the stones (there were two) with the hand through the soft faccid abdominal walls.

Vesical calculus is occasionally found in female children: in such cases the urethra should be rapidly dilated with a three-bladed dilator or a pair of dressing forceps, and the stone extracted. If the calculus is large, it should be crushed before extraction and the bladder well washed out. Rapid dilation is not, as a rule, followed by incontinence, even temporarily: in a case of our own the urethra of a child three years old was dilated sufficiently to admit the little finger, and there was no incontinence, even immediately after the operation.

The mortality after lithotomy in children is usually about 5 per cent. Death when it occurs is due either to exhaustion of the child by disease and pain before the operation, to kidney disease, or in some cases to pneumonia, cellulitis, septicaemia, or hæmorrhage.

Cystitis.—Though cystitis in children is very commonly due to stone it is by no means rare to find other causes for it; thus retention from phimosis or a contracted meatus, or possibly a growth, may give rise to it; tuberculosis of the bladder often is a cause of severe cystitis with much pain and hæmaturia, while frequent micturition with phosphatic deposit often occurs in children from such causes as errors of diet, or from no obvious cause. Rectal irritation may give rise to frequent micturition and even to hæmaturia.

The so-called 'irritable empty bladder' is a condition often described as a disease; there is no doubt that certain children are brought with symptoms pointing to stone, and on sounding there is found, but the bladder feels rough and traversed by ridges. We are, however, inclined to think this is not a pathological condition in itself, but simply the result of some passing irritation such as hyperæmiæ or phosphatic urine, since these cases seldom require prolonged treatment and usually rapidly lose their symptoms after a course of salines followed by tonics. In Mr. Hebra's view it is simply a contracted bladder resulting from stone irritation. Rectal catarrh and phimosis sometimes are the cause of this condition.

Tumours of the bladder are rare in children; one case of prostatic tumour has been already mentioned, and Owen records a case of his own, and mentions Giraldi's and Polak's cases. Shattock has also recorded a case of cancerous polypus in the 'British Medical Journal,' 1885, page 15, and several cases of sarcoma have also been met with (vide Southam); indeed sarcoma of the bladder occurs more frequently in childhood than any other form of growth.

Tubercular cystitis may be recognized, in the absence of some or other obvious cause, by pain in micturition, itching at the end of the penis, pain in the hypogastrium and perineum, frequent micturition, and sometimes incontinence. The pain may be greatly lessened by passing urine as soon as the least inclination to do so is felt; the urine is alkaline, with a deposit of pus and stringy mucus and epithelia; sometimes there is hæmaturia, and the bladder usually very readily bleeds—for instance, after gentle sounding. We have found a chain of enlarged lymphatics on rectal examination in a case of this sort, and also swelling, probably glandular, in the iliac fossa. Pressure over the bladder sometimes relieves pain. We have not found tubercular cystitis in children associated with genito-urinary tuberculosis, as is so commonly the case in adults, but the disease is not common enough to speak with authority. Terribile says the deposit is less gelatinous and more fibrinous, and the pain more constant is tubercular than in simple cystitis, while bleeding is an early symptom. Where the bladder alone is involved no casts will be found in the urine; their presence would of course point to renal mischief. Ulceration takes place after a time, and the ulcers may be single and small, or numerous and large; they are usually at the trigone.

Treatment.—Alkalies, citric or potassic, and benzoic acid are the remedies most useful as given internally, opium and bismuth being added when

such pain is present. Washing out the bladder with boric acid (gr. x to $\frac{1}{2}$ l.) is of much value in simple, but sometimes the painful in tubercular cystitis. Powdered iodoform washed into the bladder forms a coating upon its surface, and gives much relief in some cases; it appears, however, to be somewhat specially prone to cause iodoform poisoning: this method was, we believe, first used by Mr. Whitehead for indolent disease. Blandon suggests cystotomy in cases of tuberculous where the symptoms are intractable, and suprapubic cystostomy with subsequent strapping of the ulcer has been done in some instances.

Incontinence of Urine.—During the first few months of life the infant makes no attempt to retain urine in the bladder for more than a very short time: after the first year, however, constant or very frequent micturition should lead to the suspicion of something abnormal. Unusually frequent micturition may be due to mere habit, to a too often recurring desire to pass urine, or to an absolute inability to retain it. In the former the apparatus is perfect, but is by some cause or other too often excited; in the last there is either paralysis or a maldevelopment. Nocturnal incontinence belongs to the former group; diurnal or continuous incontinence may be due to either condition. Thus a child may have a frequent desire to pass water because a larger amount is secreted, as in diabetes insipidus; because it has a congenitally small bladder; because it has a stone or hyperacid urine, or cystitis, or a feeling of irritation about the penis from an adhesion or tight prepuce or a contracted meatus; or because worms or other local irritation are present. In all these conditions, except that of too small a bladder, the urinary apparatus may be quite perfect, but it is irritated.

On the other hand there may be continuous dribbling of urine from the bladder, as a result of distension and overflow from obstruction; or in case of entire absence of the bladder, or ectrocystitis, or imperfect development of the neck of the bladder or of the urethral muscles; or, again, from deficient innervation, as in paraplegia, or from imperfection of the micturition centre in the spinal cord, as seen in some cases of spina bifida. Mention must also be made of certain rare conditions, such as an abnormal communication between the bladder or ureters and the exterior. Obviously a child that can hold its water during the day can have none of these conditions; hence, when a child is brought and said to be unable to hold its water, the first question is whether the condition is nocturnal only or constant. Dribbling from over-distension due to obstruction is nearly always the result of either an impacted urethral calculus or of phalloitis, less often of a contracted meatus, though, of course, in those there is, as a rule, complete, or almost complete, retention rather than overflow.

Inability to retain the urine is occasionally seen associated with hyper-spasms and incontinence of feces: in such cases the condition is no doubt due to actual maldevelopment of the sphincters.

Dribbling from paraplegia will be recognised by the associated paralysis, so too with the case of spina bifida: hence examination of the spine should be made in all cases, and the child's general condition should also be inquired into. Failing these, careful examination as to the condition of the bladder and urethra should be made, to see if there is any deficiency or abnormal arrangement of these parts.

Nocturnal incontinence is much less common than nocturnal, though frequent micturition without any actual inability to retain urine is common enough; in such cases the sources of irritation already mentioned should be sought for and removed. Sometimes a child, the subject of nocturnal incontinence, passes urine frequently by day, but is able to retain it.

Ordinary nocturnal incontinence (or enuresis, as it is sometimes called) is more common in boys than in girls; it may occur at any age before puberty, but very rarely persists beyond that time; if it does so it is usually venereal, and this rare condition is said to be most often met with in girls.

The discharge of urine may take place once or several times during the night; perhaps most often during the first sound sleep, and again in the early morning.

In cases of nocturnal incontinence those conditions which have been mentioned as giving rise to a frequent desire to pass urine during the day should be looked for, since, when the child is awake, he may be able to control the flow, to pass his urine in a suitable place; while during sleep no such power is exerted. Other causes, such as unduly deep sleep, due in some cases to the semi-phyllated condition caused by enlarged tonsils or polypoid adenoids, dreams in which the child imagines that it is properly passing its water, gastric disturbance from late or unwholesome meals, temporary pyelitis from free drinking of fluids at night, and perhaps masturbation, may be added to the list. We have also reason to think that over delicacy of health, often combined with a somewhat irritable and easily excited mind, such as is sometimes seen in children born or brought up in hot climates, may give rise to enuresis. Possibly in some cases renal calculus or pyelitis of tubercular origin may give rise to incontinence.

Treatment.—Setting aside the irreducible malformations and the cause due to paraplegia, the first thing is to look for and remove any of the sources of irritation. If there is phlebotomy, excision or the breaking down of adhesions; if there is a small incision, enlargement by incision will be required. The bladder should, of course, also be sounded in any case of doubt, or if the condition does not speedily yield to medicinal treatment. The urine should be carefully examined for over-acidity or for evidences of cystitis, and this should be corrected by the use of citrate of potash or liquor potasse; the child should be carefully dieted and an allowance of meat curtailed, while any irritating vegetable food, such as rhubarb, should be forbidden. Late meals should not be allowed, nor should the child take any fluid for an hour or two before going to bed. Too great a weight of bed-clothes and the habit of sleeping upon the back should be avoided; in the latter, the immediate contact of the urine, as it enters the bladder, with the trigone is believed to excite the effort to empty the sac.

For nocturnal incontinence alone the most successful drug is undoubtedly belladonna, or, still better in some cases, atropia. Belladonna should be given in full and increasing doses: for a child two years old it is well to begin with five or ten drops of tincture three times daily, and increase the dose by five drops every twelve hours till the physiological effects are produced, bearing in mind that children are not usually susceptible to the action of the drug; as soon as this point is reached the dose should be continued for several days. If the treatment is successful it should be continued for a

week, and then the dose gradually diminished, increasing it again if there is any relapse. We have seen liquor anesthetic given at night in 2-minute doses, repeated gradually, cure a child two years old in which bedwetting had failed. The drug probably acts both by stimulating the contraction of the sphincter muscles and by acting as a sedative. Bromide of potassium, alone or with belladonna, opium, cantharides, nitrate of potash, camphor, and other drugs, have been employed. Strichnine is chiefly of use in diurnal incontinence, though sometimes it succeeds in the nocturnal form; it is said by Bouchard to be a dangerous drug for children. Such treatment as blistering, or painting over the orifice of the urethra with nitrate of silver, or the use of a penile clamp, is not to be recommended. The child should be made to pass water just before going to bed, and should be taken up again in an hour's time, and if possible once again during the night; he should be encouraged to try to control the inclination and to exert his will, but on no account should he be threatened or punished, except possibly in the exceptional cases when, as sometimes happens, the presence of one child with incontinence in a school induces an epidemic, as it were, among the others: in such instances probably the affection is in the acquired form simply a trick, and may be controlled by fear of punishment. The disastrous results of frightening such children into tying strings round the penis, as well as the misery inflicted by the shame of believing that what is really a disease is a fault, are sufficient arguments against such cruelty. Cold sparging to the perineum is sometimes useful, and we have known the use of the constant current, one pole being applied above the pubes and the other in the perineum or over the scrotum, to succeed where other means have failed; the interrupted current also sometimes answers. The application of nitrate of silver to the neck of the bladder is advocated by Holmes. In weakly children and in cases of diurnal incontinence, when no organic cause can be found, traces, iron, strychnine, good food, and sea air will often prove successful, and we have known sea air cure strabismus. The possible existence of chronic renal disease or diabetes must be borne in mind.

In moderate cases in girls dilatation of the urethra and exploration of the bladder may, as pointed out by Owen, cure the affection even if no organic disease is found.

Retention of Urine.—The causes leading to retention of urine are continued under their several headings, but it may be convenient here to group them together. They are congenital malformations, impacted calculus, phimoses, ruptured or strictured urethra, including stricture of the meatus, pressure on the urethra by abscess or a new growth, blocking of the orifice of the urethra by a vesical or prostatic tumour, or, lastly, the tying of a string round the penis. It must be remembered that retention of urine may be voluntary, or imaginary on the part of the friends: voluntary when the passage of the water causes pain, as is often seen after circumcision, when the urine flowing over the surface causes discomfort. We have never seen any harm other than alarm to the friends result from this voluntary retention, though it is well in such cases, if a warm bath does not relieve the retention, to pass a catheter into the bladder. Lastly, retention must not be confounded with suppression of urine from any cause. Of course, retention of urine if unrelieved will lead to extravasation, the treatment

of which is free-tissue deeply into all the infiltrated tissues, so that a free outlet for the urine already extravasated is provided, as well as any further mischief prevented.

Malformation of the Genito-urinary Organs. Ectroversion of the Bladder.—Deficient closure of the ventral lamina, giving rise to hernia of the abdominal wall, has already been mentioned in connection with umbilical hernia (p. 147). In certain, not rare, instances, however, the lower part of the abdominal wall, from the umbilicus or its neighbourhood downwards, may fail to close, and coupled with this there may be deficiency of the anterior wall of the bladder, constituting the condition known as ectroversion or ectopy of the bladder, *ectopia vesicae*, or *hernia of the bladder*. A patent urachus or even a protrusion of the bladder wall through such a passage may also be found; *cfr.* Turner, 'Diseases of Childhood'. In this condition the lower part of the abdomen presents a red, ragged area covered with mucous membrane, which is usually excoriated from friction and irritation, often more or less coated with mucus and phosphates. From this outlet, or rather from the orifices of the ureters exposed upon it, the urine continuously discharges, keeping the child always wet, and leading to irritation of the neighbouring skin. This red ragged surface is the posterior wall of the bladder, which is usually flush with the abdominal wall; hence in some cases there is no bladder visible, though occasionally there is a slight depression. More often the surface is corrugated and somewhat protuberant, and on drawing down the penis, which is always distorted and if developed (*cfr.* Evershed), the orifices of the ureters can be seen, and drops of urine may be watched flowing from them, and often escaping in a little jet when the child cries or strains. The malformation is most common in males.

On further examining such a child, it will usually be found that the symphysis pubis is deficient, the two bones failing to meet in the middle line, and being only connected by fibrous tissue. The umbilicus may be absent altogether, or may be more or less well formed. The scrotum is always imperfectly developed, and the testes do not fully descend, usually lying in or just outside the inguinal cavity. Very commonly there are inguinal herniae developed, and these may even become strangulated. We have had occasion to operate in such a case.

According to Dr. Cameron, St. Bartholomew's Hospital Report, every specimen may be associated with talipes and other deformities; the case may be double but unilateral approximates; sometimes bilateral, sometimes with a long, loose, cord between. All grades of deformities, from mere separation of the symphysis pubis, with patent, limited pouch, but no distension of the bladder, may be met with. In the most advanced condition there may be prolapse of the bladder, through a scrotal opening, the patent may take place through the scrotum or vagina (*Wiedl, Paringg*); the first degree is an external form; while in the fourth and most severe degree there is ectroversion and distension of the bladder into two halves by the opening of the umbilical foramen into it. The condition really arises from the fact that the bladder is (1) supported by two broad processes which themselves point to the middle line, and that the normal support or suspension of the bladder, especially in an embryo, is to the body of Mother's uterine wall. (I have known the halves of the bladder take place in the third week of fetal life, so no deformity need occur at that time.)

The condition of the anal canal is interesting. Very rare, but according to Dr. Johnson (*Dejeu*). The infection is lower than usual, and the anus is usually very anterior to the usual. Hernia are uncommon. The genital glands may be absent

This deficiency, which is quite unmistakable, gives rise to much trouble, both from the constant wetting and excoriation as well as from the incapacity associated with it. It is impossible in most cases to fit any apparatus satisfactorily to receive the urine. Hence the treatment is solely operative; and even this, it must be confessed, is not always satisfactory. Attempts have been made to divert the uriners into the intestine, but not without success (T. Smith and Simon). Holman, Ayres, Wood, Gang Smith, and others have devised operations for covering in the exposed bladder; these consist of dissecting up a flap from the abdominal wall or urethra, and turning it over the bladder surface, subsequently covering over the *raw side* of the flap with other superimposed flaps from the groin. For details of the operation we must refer to works on operative surgery. Several successive attempts are often required before a good result is obtained, and there is sometimes a tendency for the flaps to retract and leave the lower part of the bladder exposed; this difficulty is met by subsequent attachment of the flaps to the scrotum or labium below, a plan suggested by Mayo Robson,¹ and one we have found of value. On the whole, the result of our experience is that the operation should certainly be done in all cases where the child is in a condition to bear a somewhat severe and prolonged manipulation, and that a great improvement may be expected as a final result (fig. 132). The child should not be operated on until it is three or four years old. It has been proposed to scrape to rid away the mucous surface of the bladder except at the orifices of the ureters, and thus avoid the irritation of the mucous secretion. We have not, however, tried this method.² After operation one of the troubles is the constant formation of phosphatic deposit upon the parts; careful cleaning and daily syringing with a dilute acid solution is required. Hydrochloric acid, η ss, glycerine, \mathfrak{ss} , water, \mathfrak{ss} , we have found a useful form of wash. If, however, as is sometimes the case, the deposit persists in spite of these measures, we have found that scraping it away from time to time with a sharp spoon is the most effectual means of getting rid of it. When the bladder surface has been covered in as shown in the figure, an appliance is readily adapted to receive the urine.

In extrusion of the bladder in the male the penis is nearly always dilapidated or developed in varying degrees; the testis may be retained, or may descend into the scrotum and be well developed. The scrotum is in most always undeveloped, when it is it remains a combination of skin.

As Tiers pointed out the calcification is not a part of the bladder itself, but that is a reflexion of all covering the bladder and neighbouring parts. The poles of the bladder and the ureters are usually dilated, and may open into the intestine, vagina, or rectum.

The treatment is typically medical and is delicate, and there may be imperious or unsatisfactory results.

For further details and references Dr. Champneys' able paper should be looked at; from it much of the above is taken.

¹ *Brit. Med. Assoc. Minutes* (1888).

² Excision of the bladder, with or without manipulation of the ureters, direct incision of the vesical purgery, with or without extirpation of the uretero-vesical pouch, or a low approximation of the ends of the ureters have also been suggested; but are difficultly manageable results from these methods, except in one case of Wilson's, have been obtained. A good summary of the various operations will be found in *Arch. für Med. der Organe Gen.-Harntrakt.*, March 1888, by Posner.

deformed, the corpus cavernosum *non deflexum* to a greater or less degree, and the corpus spongiosum is inserted on its upper surface, so that the flow of the urethra is exposed on the dorsum of the penis. The whole organ is raised and turned up against the abdomen; the prepuce is usually redundant below, and the glans is generally better developed than the rest of the penis.

Epiopadias.—The condition of penis above described may occur without eversion, constituting epiopadias.¹ In such cases there is usually imper-

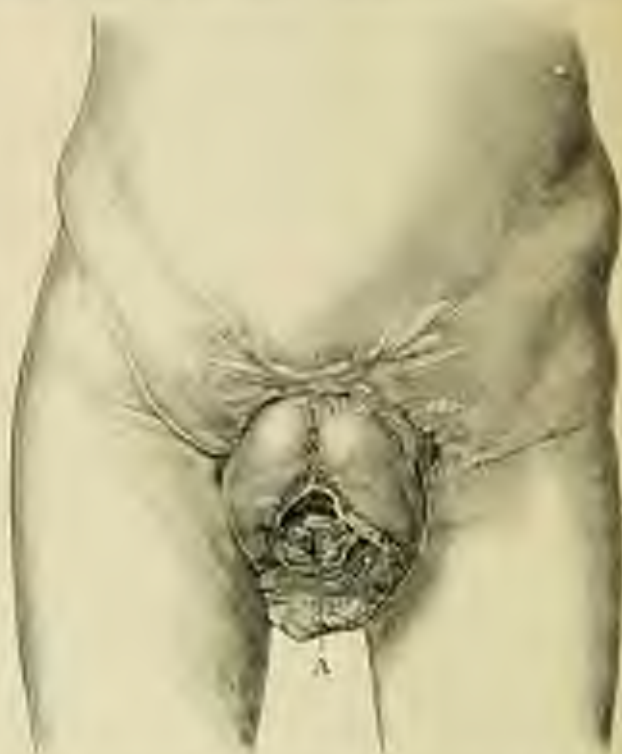


FIG. 144.—The thoroughness of a plastic operation for Eversion of the Bladder in a boy. A catheter can be used until the wound is completely healed, as pointed to the glans penis.

fect power of retention of urine from deficient muscular development at the neck of the bladder, and for sexual functions the organ is useless. In such cases an apparatus is readily applied to prevent the discomfort of constant wetting; but to improve the power of micturition, and perhaps the sexual function, operations may be performed, consisting in either turning down a hood-like flap from the front of the abdominal wall over the urethral groove,

¹ A case of epiopadias is a gift according to Smith, in *Brit. Med. Jour.*, September 20, 1884.

or in dissecting up flaps of skin and bringing them over the skinum—or, lastly, in taking a flap from the scrotum and turning it upwards over the penis, which is passed through a slit in the centre of the flap. Any small hæmorrhagic openings left after union of the main flaps are closed by subsequent operations or by repeated application of the actual cautery. In all such operations it is a good plan, as a preliminary step, to open the urethra or make a groove through the prepuce, so as to allow the urine to drain away freely, without flowing over the wound. Our colleagues, Mr. Hantle, and Mr. Hewlett, of Hull, have adopted this plan with good results.

Hypospadias.—When the floor of the urethra, together with the corpus spongiosum, is deficient to a greater or less degree, the deformity known as hypospadias is present. In the slightest cases the deformity is merely one of the urethral orifice, which opens on the under surface of the glans penis instead of upon its apex, though, even in these cases, the corpus spongiosum is always thinner and less developed than it should be. A dimple usually represents the opening of the urethra, or a groove may run on from the meatal opening to the end of the glans. All degrees of malformation are met with from this to cases where the urethra opens in the perineum, behind the scrotum. In severe cases, the corpus spongiosum being entirely deficient below, the penis is bent downwards and held down by fibrous bands representing the aborted spongy body; it is also bent down by the deficiency of the prepuce below, though a redundant, hood-like fold covers the glans above. In the severest cases the scrotum is cleft and ill developed, and the testes are retained or imperfectly descended, and the extent of development may be such as to give rise to doubts as to the sex of the individual; such are the majority of the so-called hermaphrodites.*

The slightest degrees of deformity, where the urethra opens at the base of the glans, need no treatment, and do not interfere with either the urinary or sexual functions as a rule, though we have met with a case where this condition was associated with incontinence of urine and feces, probably due to deficient development of the sphincters of both outlets. In all cases of hypospadias a probe passed into the urethra will show how thin the lower wall is, and the meatus is often contracted and inefficient. Sometimes the opening is sufficiently far forwards to serve all purposes, but the penis is tightly bound down to the floor of the scrotum. In such cases the organ may be liberated by careful dissection, but unless great caution is observed the thin floor of the urethra will be cut through, and a urinary fistula result. Where the opening is further back than half the length of the penis an operation may be performed to lengthen the channel: a preliminary cystostomy or urethrotomy having been done, flaps should be dissected up from the sides of the penis and turned over one another (method of superimposed flaps). This is a successful plan, but even it often fails from non-union, or breaking down again after partial adhesions. We more often perforate the prepuce and bring up the glans through it, and then, after refreshing the edges of the preputial fold and of the urethral furrow, unite them, completing the new floor of the urethra by subsequent operations.

* Sometimes the urethra is continued on to the glans, but there is a congenital urethral fistula further back, even within the scrotum, and urine escapes by both outlets. For details of the various forms of hypospadias, vide *Jed. Clin.*, December 1894.

Congenital Contraction of the Meatus Urinaris and Congenital Stricture of the Urethra have already been mentioned. We have met with two instances of the latter: one, seen in adult life, was remedied by catheterism in the ordinary way; in the other, an infant, there was retention of urine, with overflow. On passing a catheter two distinct obstructions were found, one at the front of the scrotum, and the other in the prostatic region: they appeared to be definite bars of thickened tissue, the latter closely simulating gonocœcal enlargement, which, if it existed, only affected the middle lobe.*

Congenital contraction of the meatus may become an important affection, giving rise to incontinence, to retention and consequent cystitis, and indeed to all the secondary troubles associated with obstruction to the urinary outflow. In one instance a boy of five years old was brought to us, who was said to have had gonorrhœa for three years, and was believed to have been tampered with: there was a distinct gleet discharge, and the meatus was very small. All the symptoms disappeared after dilating the meatus and passing a catheter a short distance down the urethra at frequent intervals for a few weeks; the child was subsequently neglected, and re-contractions took place. The following case further illustrates the evils of a narrow meatus:

Congenital Malacodonuria. *Autopsy*—An Egyptian (young), died in December, 1876. With 38 yrs. with labour admission, when he was unable to pass urine when pain manifestly had pain in his abdomen and became ill by himself; soon passed blood; was admitted to the hospital some time, and was treated some liberally, the admission was found to have a contracted meatus, and was catheterized, it was increased (not too much) being passed a few times, up to 100, 150, 170, and 180, slight enlargement of meatus and dilatation of the bladder was observed. The edges of the meatus were found to become glued together, and he was induced, not by violent straining, to pass urine himself; and the bladder continued to get round the catheter. December 11, the meatus was found to enlarge the meatus, and a No. 8 silver catheter passed freely through the meatus, and was into the bladder. He was discharged on the 14th with all his symptoms relieved. It is a useful and interesting case in children, as showing the effect of continued retention of urine (distension). Here probably some disease led to stricture and contraction of the meatus, the play of which were probably acting as valves, which shut by the pressure of the urine.

Incomplete obliteration of the urethra may also be met with, as in a case recorded by Partridge and Watson.[†] Mr. Gay and others have referred cases of double urethra, one on the dorsum and the other in the normal position, both communicating with the bladder, though not with each other.[‡]

Prolapse of the margins free edge of the urethra in girls may be caused by straining; it gives rise to pain, bleeding, and irritability of the bladder. Day, who describes the condition in the *Medical News*, Dec. 1883, advises astringents in mild cases, and removal by ligature of the prolapsed part in more serious instances. Dr. Cooley removed the prolapse by radial incisions and obtained a good result (*vide Brit. Med. Jour.* November 1, 1890, also April

* Dr. Munk, *St. Louis Med. and Surg. Ass.* November 1875, mentions a case of enlargement of the middle lobe in a child of Eastern origin: the swelling proved to be a cystitis.

† *Phil. Soc. Trans.* vol. xiv. The meatus were occasionally dilated: one lobe was unopened, and the urine ended in the bladder; other deformities also existed. Another case, treated successfully by a sort of forced catheterism, is recorded by Foster, of Darlington, *Brit. Med. Jour.*, January, 3, 1873; also *Sturrock, Lancet*, February 11, 1877.

‡ *Phil. Soc. Trans.* vol. xiv.

18, 1890). Vascular growth of the *megas* urination is occasionally met with in children (vide *Evo. Lancet*, November 1889).

We have seen one case of complete absence of the penis, the urethra opening just at the margin of the anus, outside the external sphincter; the urethra and testes were well developed. The child was under the care of our colleague, Mr. Collier. For an account of other malformations of the penis, such as version, adhesion of the penis to the scrotum, double penis, penis fistula, &c., we must refer to Mr. Jacobson's work on 'Diseases of the Male Organs' (1895).

Phimosis, is the condition where a long prepuce hangs which cannot without difficulty be drawn back over the glans on account either of the small size of its orifice or because of adhesions; is an affection which may be congenital or acquired. Further, it varies much in degree: the prepuce may be very long and end in a puckered, tapering point, in which case is but a pathetic orifice. Turner has found it absolutely imperforate. Where the opening is very small when urine is passed it collects between the glans and prepuce, and "balloons" out the latter, or the prepuce may be tightly stretched over the glans and universally adherent to it.

In most children at birth the prepuce loosely covers the glans, and notwithstanding adhesions are very often found between the two, while the central groove is filled up with retained smegma in round lumps; if these adhesions are not broken down and the glans kept clean, secondary inflammation is apt to occur (balanitis) and give rise to still farther adhesions, with perhaps increased contraction of the prepuce. In most cases, with a little trouble, the foreskin can be drawn back, the adhesions being torn down by the finger and thumb or a probe; the adhesions are frequently non-vascular, at other times a few drops of blood escape. Daily retraction and cleanliness for a week or two get rid of all further trouble, occasional drawing back and washing being all that is afterwards required.

If phimosis is neglected, many ill results may follow: retention of urine flows obstruction at the preputial outlet or at the meatus: as a result of such contraction extravasation of urine may occur, or isostentance of urine from irritation. Prolapse of the ectham and hernia may result from the straining required to empty the bladder or from irritation: while cystitis, balanitis, formation of preputial calculi, metastases, and in later life sterility and increased liability to venereal diseases and epithelioma may result from neglected phimosis. Other troubles, such as paraphimosis if a tight prepuce is drawn back, and, according to Mr. Barwell's view, possibly joint lesions from reflex irritation, may occur. Sayre also records cases of various constitutional and deformities of the lower limbs resulting from phimosis.

If the obstacle to retraction is simply the adhesions, the breaking down of these, already mentioned, is sufficient; if however, the preputial orifice is tight, circumcision should be performed in infancy. Dilatation of the prepuce answers in some cases; but we are strongly opposed to it, since we have seen not only rapid re-contraction but also much inflammation set up, necessitating circumcision and a long delay in healing; it is not a good plan.

In any doubtful case it is wiser to circumcise, as the operation is as harmless as any operation can be if done properly.

In every male infant the condition of the prepuce should be attended to.

during the first few weeks of life; much subsequent trouble may be thereby avoided.

There are many ways of circumcising, of which we will only describe the two we prefer. Sitting up the prepuce should never be done in children; it is much better to circumcise properly.

The child should be anaesthetised and a tape tied round the root of the penis; then, with a pair of dressing forceps, the prepuce should be seized just in front of the glans, but it is not to be drawn forwards so as to put it on the stretch, or too much skin will be removed. The forceps should be held vertically, and the skin in front of them shaved off with a scalpel; but at the lower part of the incision the knife should be turned forwards so as to make a little triangular tongue of skin projecting from the cut edge of the prepuce; the dressing forceps are now removed and the skin retracted; the mucous membrane is next slit up along the upper surface of the glans with a pair of scissors, and clipped away all round as far as the frenum, leaving enough rim of mucous membrane to readily hold the sutures; the frenum should not be clipped close. Interrupted catgut sutures are used to attach together skin and mucous membrane, generally one on the thymus and one on each side are sufficient; the little tongue flap is then attached to the frenum and made to cover its raw surface; by this means, which was shown us by Mr. Davies Colley of Guy's many years ago, rapid healing is nearly obtained and there is no raw surface to granulate. The tape is removed and the patient kept lying down for a few days. We often slit up the prepuce with scissors, and then clip away the required amount of skin; by this means it is easier to estimate exactly the length of foreskin to be left. It is better to do without any dressing, simply keeping the clothes away from the part by a cradle. If there is any troublesome oozing, a strip of lint may be wrapped round the penis, leaving the sutures exposed. Bleeding should be carefully arrested before putting in the sutures. Covering over the penis with a thick pad of cotton wool in a hollow of which a large mass of vaseline has been put is a good plan (Harkn).

In a perfect circumcision the edge of the prepuce will just cover the corona; if too much is removed the corona is apt to remain tender and irritable for a long time. If catgut sutures are used they do not require removal. The Jewish mode of circumcision does not, we think, give such good results as that above described. Martin alleges that circumcision may produce contraction of the meatus, as a result of exposure and friction, and various secondary reflex irritations, which he has relieved by dilating the meatus; but we doubt the occurrence of any bad result from circumcision properly performed, and think any such troubles are more likely the result of the condition for which circumcision is done.

Balanitis is often met with in children, and is usually the result of neglected phimosis; the prepuce may be much swollen, and large quantities of pus are sometimes discharged from within it; there is much itching pain on micturition. Mild cases are readily cured by syringing out the cavity beneath the prepuce with warm water or lead lotion. As soon as the acute inflammation has subsided circumcision should be performed; it is sometimes necessary to circumcise at once, but in such cases the wound is apt to be slow in healing.

The trick of tying a string or tape round the penis, for mischief, or to prevent the need of passing urine, is to be thought of in cases where a child is brought with swelling and inflammation of the penis; the string may be completely buried in the soft parts, and may give rise to ulceration or even sloughing, urinary fistula, &c.

Congenital Paraphimosis is the condition where the glans is congenitally uncovered by prepuce; it is not a common condition, but is always found in hypospadias, even in the slightest degrees.

Acquired paraphimosis is produced by retraction of a tight prepuce, so that the glans is exposed; it is usually the result of mischievous meddling with the penis. If the prepuce is not speedily drawn forward again, the tight position constricts the penis behind the corona and interferes with the venous circulation both in the prepuce and the glans: the result of this is swelling and pain, the swelling being chiefly of the prepuce, since its tissue is more lax than that of the glans. If the condition is neglected the appearance becomes somewhat alarming; there is much oedema, often redness, and some ulceration with distortion of the organ. Since the constriction is tightest on the dorsum of the penis, there is little or no risk of ulceration into the urethra, and still less of complete gangrene, as has been sometimes stated, but much trouble and no little alarm are often caused by this condition, and we have known it give rise to suspicions of erysipelas; it might also possibly be mistaken for extravasation of urine or cellulitis. The treatment of the affection consists in drawing forward the prepuce again; to do this the swollen foreskin should be punctured with a needle and all the serum squeezed out. By then drawing forward the prepuce with the fore and middle fingers of both hands, at the same time pressing back the glans with the thumbs, reduction can be accomplished, unless the constriction is very tight or of long standing. Another method consists in winding a piece of tape or narrow elastic round the penis, from the glans backwards, and so, by reducing the size of the glans, the foreskin can be brought over it. Where the paraphimosis has existed for more than a few days it may be intractable; or, if the constriction is very tight, it may be necessary to divide the contracted prepuce behind the corona, but this is rarely required. Under such circumstances the swelling is to be reduced by puncture and a lead lotion dressing applied; in time the parts will model down, and, though permanent paraphimosis rarely results, no serious harm occurs. After reduction of a paraphimosis, if the foreskin is long and tight, circumcision should be performed, or in any case measures taken to prevent a repetition of the retraction.

Masturbation.—Masturbation in children is usually the result of a long prepuce, or retained secretion, or of some other source of irritation about the pelvic organs in either sex, such as worms, bilantia, vaginitis, stercoræ, &c. The treatment obviously in such cases is to remove the source of irritation; circumcision is in obstinate cases desirable, both as a means of removing irritation and as a deterrent, while in older children, who are able to understand the matter, and in whom the habit is a bad practice, and not the result of any obvious physical cause, judicious speaking, pointing out the uselessness and the debasing effect of the act, is the best line of treatment. Coupled with these plans should be care in avoiding opportunities, and, if necessary, punishment should the vice be persisted in. In all cases

children should be treated first as a disease and only as a *residuum* is clear that no cause for it exists.

Oedema of the Scrotum in children is sometimes met with apart from any obvious inflammatory condition: it may be part of a general oedema due to cardiac or renal disease; in other instances it is the result of stasis, such as is met with in fat and dirty children; occasionally it occurs without obvious cause, and in such cases some source of obstruction to the lymphatic venous circulation should be looked for. Erysipelas, or diffuse cellulitis of the scrotum, penis &c. is also occasionally seen. In all these conditions attention to the general health and the use of local lotion are usually all that is required.

Diseases of the External Genitals in Females.—The congenital malformations of the external genitals of female children, apart from acquired hermaphroditism, are rare, with the exception of the simple adhesion between the labia minora of the two sides, which, as Mr. Holmes has pointed out, is neglected, may produce retention of menses in later life, and probably form the majority of the cases of so-called imperforate hymen. The treatment of adherent labia is very simple: the adhesions are broken down *gradually* with a probe, and a little ribbed lint kept between the labia for a few days, together with ordinary cleanliness, is all that is required.

Hypertrophy of the labia or clitoris in children, though common among the natives of some hot climates, is very rare in this country. We have, however, occasionally seen it, though rarely to an extent that required treatment. In a young adult, however, we have had occasion to remove hypertrophied labia, the condition having lasted some years, but whether it was congenital or not we cannot say. Nothing short of operation is likely to be of any service. We have recently seen a case in which the clitoris of a little child was much enlarged and caused irritation; examination showed that there was adhesion of the prepuce of the clitoris to the glans, with retinal integument, just as in the case of phimosis in the male.

Narxus of the labia is seen every now and then, and is best treated by puncture with the actual cautery.

Of acquired affections, simple **Vaginitis**, or, as it more commonly is, **vulvitis**, is frequently met with; it is usually caused by neglect and dirt, and often by the irritation of thread worms, but is sometimes the result of inoculation with the discharges from other cases of vulvitis, or from other people by the use of dirty sponges for washing &c. Very rarely indeed is it the result of attempted rape, and such charges are often brought against innocent persons simply because the mothers conclude that all discharges from the genital organs in children must be venereal; and it should be remembered that some children are led to insert stones or to cohabit suggestions made by ignorant or dishonest mothers.

This simple vulvitis is very contagious in many cases and readily spread from one child to another; hence isolation, perfect cleanliness, the removal of sources of irritation, and the free use of antiseptic lotions such as perchloride of mercury or boracic acid should be employed. In some cases astringent lotions such as sulphate of zinc or alum are useful, and isolation should be well insisted on in the vulva. In rare instances are focal processes

¹ Kossow and Dr. Amshel have found gonococci or non-specific blennorrhoea in children. *Rev. Nove. de Méd., de l'Enfance*, December 1884.

issues of granulations in the vagina in a case that had long resisted ordinary treatment; in this case nitrate of silver proved the best application.

The so-called **aphthous vulvitis** is a superficial ulceration occurring not rarely about the labia in ill-nourished, neglected, and unhealthy children, especially common as a sequel or complication of one of the exanthema. It arises also in some cases of nephritis, and may simulate the severe disease, noma, from the presence of dried blood on the surface giving the appearance of sloughing, as in the following case:

Case Syphilitic. *Ulceration of Labia.*—Male C., age 2 years. Admitted October 17, 1885. Two months ago an eruption appeared on the face and head, which has lasted ever since; the first brought the labia here lower swollen and sore, small spots appearing here and there (continues for the last few days); it did not let him pass urine since the 11th, bowels open this morning, motion quite black. On admission, pale, partly bluish (cold), thin with small nodules and superficially ulcerated; no vaginal discharge; some superficial ulceration around the right ear, scabious patches on the head, covered with black-crusted scabs. 18th, seems very feeble; no urine passed until this morning, and then into the bed; urine is yesterday, some thermal waters were about 112°; eyes puffy; does not take food well; found dead in bed at 4 p.m. The vulva was covered with varicose small and florid lani, and carbonate of ammonia and boric with strong lead was and was given. Temperature, 98th, M. of A. N. York.

Post-mortem.—Both lungs rather congested and indurated; no pneumonia; heart normal; kidneys scabrous; weighed together 7 gm., not very congested; in one, cortex fine granular (like sclerous nephritis) with red points; the ulceration on the vulva and head was quite superficial; there was no sloughing; it extended all over vulva to the normal orifice.

The treatment consists in cleanliness, free stimulation, and abundant nourishment, together with such measures as the disease with which it is associated demands.

According to Savarin aphthous vulvitis occurs most commonly in children of lives two to five years, and usually is a sequel of measles; the patches begin as blisters and then ulcerate; they may finally become gangrenous. There is some fever and the parts around are swollen, but there is very rarely lymphatic enlargement. The labia majora are most often affected, but the process may spread to the perineum, groin, &c. The disease has a certain resemblance to diphtheria and syphilis, but is distinguished from the former by the imperfect membrane formation, and from both by the multiplicity of the ulcers, the absence of lymphatic enlargement, and the history. The prognosis is favourable unless gangrene occurs, and the best applications are boric acid and iodine.* Tubercular ulceration may be met with about the vulva as in other parts.

Noma Pudendi.—Noma pudendi or noma vulvæ is a gangrenous affection of the external genitalia, of precisely the same character as cancrum oris; it runs a similar course, occurs under the same conditions, and requires the same treatment. It is quite as fatal as cancrum oris, if not more so; it is, however, much rarer: many of the cases of so-called noma are merely aphthous vulvitis. We have very rarely seen well-marked cases. More has found an organism in noma that he regards as pathogenic.†

Warty and cystic growths are mentioned by Mr. Holmes and others as

* *See Savarin, &c. *Ann. du Méd. de l'École*, May 1844.*

† *Med. Record*, January 1885.

having been met with about the vulva and vagina in children, and would require treatment on general principles.

Hæmorrhage from the vulva or vagina is occasionally met with in infancy, but is of trivial importance and requires no treatment (Holmes); it is (Superior Disease) incidental to Birth.

Irritable Mammeæ.—Irritable or painful mammae are not uncommon in girls of from ten to fifteen years. There is slight enlargement of the glands, which are tender; the pain is variable: usually one breast is affected at a time and the other is attacked later. This condition is usually met with before menstruation has occurred, but is probably associated with the physiological growth of the organs. A similar condition is met with to a less marked degree in boys about puberty. Occasionally the condition is deeply hysterical. Treatment seems to be of little use, but all the cases yet known have got well. Belladonna and strapping locally, with tonics and exercise internally, should be tried.

In infants the breasts occasionally suppurate; this is usually the result of rough handling on the part of superstitious nurses,¹ and may result in permanently stunted or retracted nipples.

Abnormalities in the Descent of the Testicles.—In the fully developed child the testes should be in the scrotum at birth, or rather shortly before birth;² it is not, however, rare for their descent to be delayed for many periods—they may even pass into the scrotum as late as the time of puberty. Most commonly descent takes place between the second and tenth year (Hansen, quoted by Jacobson); if the testicle does not come down by the end of the first year, Curling says it is usually accompanied by a hernia. In some instances the organs are permanently retained within the abdomen (cryptorchidism); sometimes one testicle descends, the other being retained (anorchidism). When the testes have not reached their proper position they may be found in the abdomen, at the inguinal ring, in the inguinal canal, in the upper part of the scrotum, in the perineum, or even in the thigh;³ and instances of descent of the testes through the femoral sheath are on record. Usually the glands are movable, and, though they may generally occupy one particular position, they may often be drawn down or pushed up beyond that spot, just as their situation alters according to the contraction or relaxation of the cremaster and dartos under ordinary circumstances.

We still know so little of the descent of the testicles that the cause of failure of this process must at present remain somewhat obscure. Possibly failure is the action of the gubernaculum, possibly simply a lack of development; certainly sometimes adhesions to surrounding parts, as the funicular process, the intestine, or the mesentery, prevent the descent. Premature closure of the funicular process, contraction of the inguinal ring, is a deficient development of the scrotum in some cases, perhaps account for the failure; other less frequent causes, such as shortness of the va-

¹ The breasts are pulled up to "break the apple string," with the idea of preventing extrusion of the nipples in later life.

² Casper found the testes in the scrotum at birth in thirty-three cases out of seventy.

³ Englebrecht of the testis into the thigh has been accounted for by the fact that some fibres of the gubernaculum testis pass downwards into the upper part of the thigh.

delivered a living microscopium, allowing the testis to float freely in the abdomen, fusion of the two testes, or an enlarged epididymis, are mentioned by Jacobson.¹

The condition of the glands when they are in an abnormal position is a question of importance: they are often imperfectly developed. In other cases, however, they are in no way defective, and cryptorchidism by no means necessarily implies sterility, while vasectomy is, of course, fractionally still less important.

Apart from functional impairment, various evils may attend imperfectly descended testes. From their abnormal position and diminished mobility they are in many cases more exposed to injury, as, for instance, when they are lodged in the perineum or in the canal. If a testis becomes inflamed from injury or other cause, the symptoms are likely to be much more serious if the gland is retained within the abdomen or in the canal, while retained testes are said to be frequently the seat of new growths.² Most important, perhaps, of all is the effect of an imperfect descent of the testicle upon the formation and persistence of hernia. By keeping the inguinal canal still wide open, the misplaced organ directly encourages the descent of a hernia.

When the gland acquires adhesions to the bowel and then descends into the canal, or even when the adhesions result from descent of a hernia after the testis, the matter is still further complicated, and great difficulty in the management of such cases may arise.³ It is quite common for a child to be brought with the statement that it is ruptured, and that it has perhaps been wearing a truss—but this is said to have been always painful, and the child

¹ *Diagnosis of the Male Organs of Generation*, 1863; with also Lockwood, *Brit. Med. Jour.* 1887.

² Especially, according to Virchow, when they are retained in the inguinal canal; he points out that chronic dislocated tumours, as the disease of any more obvious connection, demand close examination for an undescended testis.

³ The caecum may descend with the testis in consequence, possibly, of unusual strength or abnormal arrangement of that portion of the mesocolon, called the "plica vascularis" (see Lockwood, *Brit. Clin. Trans.* 1881).



Fig. 112.—The right testis is undescended, and is seen forming a swelling in the inguinal canal.

scrotum all the while it is on. Examination shows an undescended testis lying in the canal, which has been pressed upon by the tumor, and, *of course*, the child could not bear it. In such cases the undescended testis is also the supposed hernia, though frequently enough the two conditions co-exist, and a reducible hernia is found or detected above the testicle. We have met with a case in which both testis and hernia were strangulated; we removed the testis, closed the canal, and the patient made a good recovery.

The late Mr. John Wood made some valuable remarks upon this subject in his lectures published in the 'British Medical Journal,' June 1885. Where a hernia and an imperfectly descended testis co-exist, the gland, if swollen, may be removed; if adherent to the bowel it may be returned within the abdomen, and the ring closed, or, if possible, may be separated, drawn down into the scrotum, and fixed there, the sac and canal being closed above it. In funicular hernia a narrow ligature may be made by denuding part of the funicular process, and bringing it down into the scrotum; if the cord cannot be drawn out enough to let the gland come down, the epididymis may be loosened from the testis, and the latter turned down so as to reach the scrotum. All Mr. Wood's results in these operations were good, with one exception. The diagnosis of undescended testis is not often a matter of difficulty: an examination of both sides of the scrotum will generally clear up the case. But we would suggest a word of caution not to be satisfied with one view in an investigation: sometimes one testis may be down, and, unless both are felt for at the same time, may slip about, so as to feel as if it belonged to either side: sometimes, too, an empty scrotum may be felt, but a little examination and manipulation of the canal, or the application of heat, may bring down the testicle; and the case may turn out to be merely one of retracted, not retained, testis.

Occasionally a hernia, if it contains thickened omentum or glands, may be taken for a testicle or a hydrocele of the cord, or a fibrous or fatty tumor may simulate a tumor in the canal. There is considerable variation in the size and firmness of the testes of young children, and we have frequently seen mistakes made about these conditions.

The treatment of undescended testicle is an important and sometimes difficult matter. Where in an infant or child three or four years old there is an undescended or imperfectly descended testicle, with no hernia, nothing should be done except gentle attempts to bring the gland further down by pressure from above with the fingers; this manipulation should be repeated frequently during the day. In an older child, up to the age of puberty, the same line of treatment should be adopted as a rule: if, however, the testis gives rise to pain or trouble, an attempt may be made by operation to bring it down and fix it to the bottom of the scrotum. Mr. Wood had some successes, as already stated; we have performed the operation in a good many cases, but though it is sometimes successful we have found that there is often a great tendency for the testes to again become retracted. The scrotum in such cases is often small and ill-developed. The operation consists in exposing the testis as in an operation for hernia, and passing a silk or catgut stitch through its outer tunic, or between the gland and the epididymis, and then bringing the suture out at the bottom of the scrotum and fixing it there. Testis in peritonæum is probably best treated by replacing

it is the scrotum—by operation, if possible; if not, and its presence gives rise to trouble, it should be removed. Mr. Jacobson advises that all such operations should be postponed till after the first or second year. It is essential to freely separate the testis from all the adhesions which usually exist, so that it lies quite readily in its new position, even before it is sutured there. The adhesions may be remains of that part of the gubernaculum which is attached to the tubercle of the os pubis, and this may explain the abnormal position of the testis.¹ Displacement of the testicle into the perineum is sometimes the result of dislocation, and is not congenital: under such circumstances it has been successfully replaced.²

We most strongly protest against the use of a truss for undescended testes in young children with a view of keeping it out of the way, or preventing the descent of a hernia where no rupture already exists; we cannot but consider the plan unnecessary and unscientific except in the cases where the testicle is inseparably adherent to the bowel, and, as this can only be ascertained by operation, we think it is wiser to operate in doubtful cases, separate the testis, bring it down, and close the canal as it if possible. If this cannot be done, the testicle should either be removed—which should be only done, as a rule, when the testicle is small and wasted, and can be separated from the gut without risk of injury to the bowel—or, after reducing it into the abdomen, the canal should be closed; hence it is only in such cases that any obstacle to the descent of the testicle should be interposed.

Should an undescended testis become inflamed from injury, from venous or from pressure within the canal, the symptoms may be severe, and may resemble those of strangulated hernia—the absence of the gland from the scrotum usually clearing up the doubt; if, however, there is any uncertainty about it, or the symptoms do not speedily subside, the parts should be explored, and the inflamed or gangrenous testis is generally better removed. Fatal peritonitis has resulted from this condition.

Jacobson, in his well-known article in Holmes' *System of Surgery*, and Book IV. 'Diseases of the Male Organs,' advises the use of Dover's powder, hydrag. c. creta, and hot poppy fomentations in these cases in the early stage; to this work we must refer for further details on this subject: to it we are indebted for many of the points in the present chapter.

Where a hernia coexists with an undescended testis, but the two are not adherent, the best treatment is to apply a truss of special size and shape for the particular case, made so as to lie between the testis and the canal, and, while the rupture is kept up, the testis is pressed downwards. We have employed this plan usually, and by its means both defects may be cured. Should the truss fail to procure closure of the canal, the hernia should be dealt with by the operation described in p. 150; the funicular process being closed above the gland, the descent of the testis will be favoured, and an attempt may be made at the same time to fix it in the scrotum.

Supernumerary testicles hardly ever occur. Most of the supposed instances have turned out to be either hydroceles of the cord, hernia, or solid tumours. Lane has, however, recorded a recent case. Congenital absence

¹ *Phil. Locomot. Med. Club, Trans.*, 1880.

² *Victor Horsley, Med. Times and Gazette, December 1881.*

of the testes is disengaged from sperm-secretion, even in an exceedingly rare condition and usually associated with other malformations.

Deficiency or closure of the vas deferens is occasionally met with: in such cases the testis is well developed, but, of course, infertile. Inverted testicle, where the epididymis lies in front of the gland, is sometimes a congenital, sometimes an acquired condition: it may be of importance in view of the appearance of a hydrocele or hernia, or as a predisposing cause of tumor of the testicle.

Mr. Jacobson's table of the communications of inguinal hernia is as far as I know original in its arrangement:

1. The testis may be retained (a) in the scrotum, (b) at the inguinal ring (c) in the inguinal canal (d) just outside the external ring.

2. The spermatic tube, as observed from its exit to the peritoneum (b) the sperm cord.

3. Retained testis may become inflamed by gonorrhoea, but gon. test. is probably very seldom a gonorrheal focus, or may become the seat of tubercular disease, or malignant growth, or may atrophy.

4. Displaced testis may be communicated with hernia: (a) from adhesion of contents to the external ring, or (b) from overlying pulsary of the femoral vessels.

5. Hydrocele may be a complication, or (b) an acute condition from inflammation (phlegmonous) some undelimited portion of the peritoneal epithelium, or (b) a chronic affection: in either case there is but a communication with the cavity of the peritoneum, or (b) a hernia (not the normal one) exists.

Congenital displacement or Hernia of the ovary sometimes occurs, one or both organs protruding into the inguinal or even into the femoral canals, and occasionally in later childhood a similar disposition occurs. We have seen both ovaries protruded into the inguinal canals in a case of tubercular ascites, the ovaries returning to the abdomen on the subsidence of the fluid. If ineluctable, the trusses may give rise to trouble in later life from their enlargement at the menstrual periods, as well as from their pressure keeping the inguinal canal patent: hence, where possible, they should be removed to the abdomen and kept back by a truss; occasionally an operation as for hernia is required.

Diseases of the Testicle in Childhood.—Simple acute orchitis in children occurs as a result of injury— undue pressure of a truss— or the result of an operation such as that for the radical cure of hernia or lithotomy: sometimes without assignable cause, or under circumstances mentioned in the case of hydrocele. The inflammation often results in the development of hydrocele, and there is often oedema of the scrotum; but the affection is seldom severe, and subsides readily under the use of local issues, rest, and elevation. We have never seen any immediate bad result, though it is possible that the subsequent growth of the gland may be interfered with. Orchitis from trauma is very rare in childhood: we have never seen it. Acute inflammation of the testis going on to gangrene may be a result of 'necrosis' of the testis, an accident occasionally met with, usually occurring in cases in which there is some abnormality of the organ, and very apt to be mistaken either for an acute orchitis from some other cause, or for strangulated hernia, especially if, as is often the case, the testis has imperfectly descended. Chronic orchitis may result from the acute form.

Gonorrhoeic Testitis is, in our experience, very rare; Mr. Holms mentions having seen hard knots in the testicle which were apparently gonorrhoeic; they readily yield to the use of hydrarg. c. creta. Other cases have also been recorded, and sometimes a diffuse orchitis is found. We have met with cases of enlargement of the testes in young children for which we have been made account.

Tubercular disease of the testicle is met with in two forms; as a part merely of a general tuberculosis, and as a localised condition limited to the testis alone or the genito-urinary tract. Genito-urinary tuberculosis is much rarer in children than in adults, but it is curious to find both testes tuberculous. In the former case the tubercles may be only milary and disseminated, and hence not recognisable during life, or they may form definite, hard, circumscribed masses in the epididymis, just as in adults. While the disease is limited to the testicle, it takes the form just described, giving often a sensation as of a 'dumb-bell' or double testicle; it is usually not painful, and often of slow growth. If nothing cuts short the child's life, the testicle usually at last breaks down, and a suppurating 'strumous testis' develops, with its characteristic adherent or undermined skin, livid colour, and intractable course; the cord is usually thickened.

When the tubercle is generalised, no treatment of the testicular affection is, of course, of any use; when, however, no obvious lesion exists elsewhere, the usual management, medicinal and dietary, of these cases should be carried out (cod liver oil, phosphate of lime, &c.). For the testicle itself, pressure, with occasionalunction of mercurial or iodide of lead ointment, may be used, but as soon as suppuration occurs it is probably better to remove the gland; it is in such cases most likely functionally destroyed from blockage of the efferent ducts, and is a source of general infection. The operation is sometimes advised as a precautionary measure as soon as a diagnosis can be made, but the propriety of this we think open to doubt; we have had occasion to perform the operation only once or twice, and in one case the child was seen two or three years later in good health, his brother being affected by 'general surgical tuberculosis.' In this instance the disease began at 7 weeks old, and the gland was removed at 25 months; both testis and epididymis were involved. Our colleague, Professor Dreschfeld, has recorded a case of congenital tuberculosis of the testis in which tubercle bacilli were found.¹ Herms testis occurs only in those cases where the body of the testis is involved, and when prompt castration is probably the wisest course. Occasionally the tubercular deposit gives rise to acute inflammation.

Tumours of the Testis. Tumours of the testes in children may be congenital or acquired; the congenital are rare, and usually teratomata or 'diverted,' consisting of cysts which contain hair, teeth &c. as in the corresponding tumours of the ovary.² Striped and unstriped myosarcoma have, however, also been found,³ as well as congenital adenio-sarcomata,⁴ and,

¹ Brit. Med. Jour. 1912, p. 500.

² Congenital tumours of the ovary are explained by Sussublium as diverticula of 'fetal yolk-sac,' see Owen on treatment of parthenogenesis; and by Langer as the result of 'embryonic pluripotency.'

³ Baskin and Rafelsonki.

⁴ B. M. J. 1910, Jan. 20; 1911, 1912.

according to Silexky carcinoma—though Barlin disbelieves in the occurrence of carcinoma testis in childhood.

Acquired tumours are usually sarcomata (round-celled), very rapidly growing, very malignant, and tending to involve the testicular glands very early. The large size, rate of growth, solidity, dilated veins, opacity, and bossy surface sometimes with cysts, make the diagnosis usually easy. These growths generally occur in the first few years of life, but according to Barlin are common from the time of birth to the tenth year.

Non-sarcomatous cystic disease may be met with: the cysts usually arise as dilatations of the seminal infundibulæ, and may be lined by cuboidal or ciliated epithelium. Intermediate resection is the only treatment to be adopted in a case of malignant disease of the testis, though recurrence within a year or so be expected in most cases; in simple cystic disease the same measure is required, since a diagnosis between it and sarcoma is impossible. In the case of dermoid cysts it is sometimes possible to dissect away the cysts without injury to the testis.*

Hydrocele.—Hydrocele is a very common affection in childhood, and frequently met with in quite early infancy; it may result from trauma, from

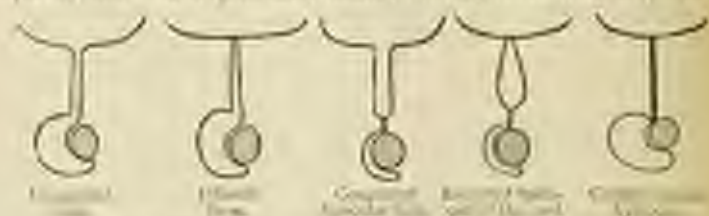


FIG. 161. Diagram of the common forms of Hydrocele of the Yachud Process. (Adapted from Jones.)

trauma, intertrigo, &c., especially when, as is often the case in that condition, the testes hang loose and pendulous. It is sometimes caused by tearing the testis being squeezed by the child while keeping its legs crossed, or by other accidents. Hydrocele may be congenital where the oblique peritoneal vaginal remnant is patent; in this case if the communication with the peritoneal cavity remains free, the fluid will flow in and out according to the position of the child. We must say this condition is not often fatal; unless the opening is a small one and readily occluded by flexion, or this form of hydrocele is more than is commonly supposed.

Infantile hydrocele, so called, is the condition where the tunica vaginalis and funicular process are distended with fluid, the process being closed in the internal ring; this is a congenital condition. Again, the funicular part of the processus may remain open, but be shut off from the tunica vaginalis; in such case a congenital funicular hydrocele would exist. Or, finally, there may be an encysted hydrocele of the cord from distension of an anastomosing segment of the funicular process.

Diffused hydrocele of the cord, described as a sort of oedema of the whole

* *Path. Soc. Trans.* 1885.

* Verneil, *Bull. Mèd. Soc.*, April 4, 1886. But a full account of Verneil's growth see Jackson, *op. cit.*

tissue of the cord, is believed to be very rare; we met with a case while searching for hydrocele of the cord, in which there was some gelatinous material lying in the tissue of the cord, superficial to the funicular process, which contained colourless clear fluid. Hydrocele (encysted) of the testis, and epididymis from dilatation of the hyaloid of Morgagni or organ of Gouliard, may possibly occur; it is, however, usually a disease of later life, and no case appears to have been recorded in childhood. (Gosselin.)

Diagnosis.—The diagnosis of hydrocele in children is made by first examining the cord, and excluding the presence of a hernia, by finding that there is no increased thickness of the cord above; next, a soft, elastic, fluctuating feeling points to hydrocele; and, finally, translucency, or the possibility of reduction gradually by pressure or elevation, without any gurgling sensation, clears up the case. It is, however, certain that hernias in infants, when the bowel contains only flatus and is much distended, are sometimes quite translucent. Mr. Hovse was, we believe, the first to point out this fact, and we have many times seen the same thing.

When there is an encysted hydrocele of the cord it is usually possible to bring it down by traction, and feel the absence of thickening above, or the testis swelling may be made to slip backwards and forwards between the fingers, quite unlike a hernia. The mode of reduction serves to distinguish a funicular hernia from a funicular hydrocele, and the absence of distinct impulse gives corroborative evidence. Hydrocele of a retained testis sometimes occurs and may give rise to difficulty; the possibility of isolating it, its immobility, and its consequence, together with the absence of the testis from the scrotum, will give the clue.

Combinations of two forms of hydrocele, e.g. of vaginal hydrocele with encysted hydrocele of the cord, may be met with, and a funicular process may contain fluid at one time and a hernia at another. Or there may be infantile hernia with infantile hydrocele. A collection of fluid may form in the sac of a congenital hernia, but is usually masked by the presence of bowel.

Engel and Camper are quoted by Jacobson as having found the processus vaginalis closed at birth in about 10 per cent. only of children examined; this supports the view that some abnormal condition of secretion in the abdominal cavity must exist to produce a congenital hydrocele, for it is certainly not as common as these figures would imply.

Hydrocele in Girls.—The funicular process in girls (catal of Nuck) is occasionally the seat of hydrocele; the diagnostic points and treatment are practically those of hydrocele of the cord in boys.

Treatment.—Many cases of hydrocele get well without treatment; those due to local irritation subside on removal of the cause. The congenital form may disappear by spontaneous closure of the funicular process; other cases subside under the use of evaporating lotions, leeching, or mild counter-irritation such as painting with tincture of iodine. The congenital and funicular varieties are usually cured by a tap, and it is seldom that hydroceles give much trouble. When, however, these plans fail, the methods of treatment are prefered are:—(1) injection with solution of pure carbonic acid in glycerite (1 part in 7) without emptying the sac of its fluid, so that the injection is still further diluted; (2) simple antiseptic incision; the sac is laid open and drained for four or five days without any stretching of the edges of the sac to

the skin, as in the so-called 'schist' operation, or part of the parietal layer of the tunica may be excised, and so the sac may be obliterated. Tapping, subcutaneous pressure, letting the fluid escape into the bowels, or into the sinuses, injection with iodine or agent &c. all have their advocates, and are not often successful; but the plans mentioned are in our opinion the safest, most, and quickest, though relapses occasionally occur, whenever method is adopted. We have seen a hydrocele develop some time after an operation for the radical cure of hernia in an infant in whom the bowel was incarcerated.

Edema of the scrotum is often met with as a result of intertrigo in children, and should be distinguished from hydrocele, anasarca, erysipelas, and accumulation of urine—also from the 'inflammatory' or 'malignant' testis, as called.

Varicocele has been met with in childhood by Bryant, Pearce Gould, and Lonsbury, but we have never seen a case earlier than about the tenth year, though we have seen a boy of thirteen with a large varicocele which had to have existed for five years.

Ovarian Tumours in children are nearly always sarcomata, teratomata, or dermoid cysts; they may appear at any age: thus Chiass¹ has operated successfully at three months, and Roemer² of Berlin at twenty months. The only treatment is abdominal section in the ordinary way. In the case of large tumours it may be impossible to make an accurate diagnosis between ovarian and renal or other congenital tumours until the abdomen is opened. Precocious puberty has in some instances been found associated with ovarian tumours. We have seen considerable development of the external genitalia, with growth of hair and discharge of blood from the vagina, in a child three years old, who was the subject of a tumour which apparently involved the liver and the right kidney. Tubercular prostatics has once been met with by Chaffey, and once by Quincy Siscock.

¹ *Practical and Theoretical Notes of Child Pathology* after tapping a congenital hydrocele of the testis. — *Lancet*, December 1884.

² *Ann. St. Louis University of Medicine*, August 1884, first met with a case of tumour in a girl of one and a half years.

³ *Pediatrics and Surg.*, June 1884.

⁴ *Journal of Anatomical and Physiological Medicine*, 1884, vol. II, 4. Eight out of eleven cases collected by Roemer recovered.

⁵ *Ann. St. Louis Univ. Med.*, 1884, vol. II, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

CHAPTER XXVI

DISEASES OF THE BONES.

Diseases of the Bones.—A full description of the subject of inflammation in bone would be out of place in the present work, but a few of the more important points may be summarised thus.

The process of inflammation as occurring in bone differs from that in the soft parts only in that the inflamed tissue is more rigid and unyielding; hence, on the one hand, the progress of inflammation may be slower, and on the other, as tension is greater, its effects may be more destructive.

As elsewhere, inflammation in bone leads to rarefaction, i.e. absorption of healthy tissue (rarefying osteitis), and this may go on slowly, and without any efficient outpouring of material to develop pus or any obvious external signs of the changes going on. The bone slowly becomes thinner and weaker, and its tissue may entirely disappear: such a change we see in the caries *sera*, or non-suppurative caries, of the vertebrae or of the articular ends of the long bones. It is in some cases accompanied by a deposit of new periosteal bone while rarefaction is going on in the interior: such a condition occurs in some instances of chronic osteomyelitis of the shaft of the femur after excision in hip disease. In these cases fractures may occur almost spontaneously, or at least from very slight violence.

Again, in other instances, the inflammatory material may be in sufficient quantity, and so incapable of becoming organised that pus is formed, and this may infiltrate the adjacent bone, and so give rise to further extension of the process, without the formation of any definite abscess: such a condition we see in some of the cases of chronic osteomyelitis of the long bones, epiphyseitis, certain forms of necrosis of the jaw, &c. Under these circumstances necrosis usually results, or if there is more abundant pus formation an abscess in bone is found.

Where, in consequence perhaps (Cornil and Ranvier) of primary fatty degeneration of bone crepascles, the bone tissue slowly dies, the dying part, acting as an irritant, gives rise to inflammation around, and the bone is slowly disintegrated, with more or less abundant formation of pus: such a process is seen in ordinary caries of a rib or of the pelvis, or the articular end of a bone. Where small islets of bone are marked out and, as it were, cut off from the rest by the surrounding inflammation, minute sequestra become detached (caries necrotica), while, if larger masses are so separated by a line of demarcation, coarser sequestra result. The last-named may, of course, be an acute or chronic process, a slow disintegration is lined supply causing gradual starvation, or an immediate strangulation causing rapid gangrene of the part (acute necrosis).

So-called 'condensing osteitis' or 'sclerosis' is in its results an hypertrophy,

making the bone denser and stronger; the new material has sufficient vitality to stand, and sufficient blood supply to support it as well as the original tissue; such a process we see in chronic periostitis, the results of which may be compared with the sclerosed base of repaired rickets.

Should, however, this deposit of new bone go on beyond a certain point, the blood channels become themselves so narrowed that the surrounding bone is starved, and so necrosis may result.

It should be noticed that while some of these processes of destruction and growth and repair are constantly seen going on side by side, as when chronic osteomyelitis causes central necrosis and at the same time the periosteum forms a new peripheral layer of bone, in others we do not see any repair so long as the disease is spreading; thus, in cases of a flat bone or an articular surface, until the destructive process ceases, no new bone is, as a rule, laid down.

Inflammation of bone may occur primarily either as a periostitis or as an osteomyelitis, the latter, often called osteitis, attacking the endosteum and marrow in the medullary cavity or in the cancellous tissue. Complication can hardly be supposed even to be the seat of a primary lesion, though constantly involved by direct extension along the Haversian canals from either periosteum or medulla, it being remembered that a thin layer of medullary tissue lies in each Haversian canal. Inflammation beginning in the epiphyseal line may be considered as an osteomyelitis.

Periostitis.—Acute periostitis, phlegmonous periostitis, or 'arborescence,' is a disease essentially of childhood and youth, rare in infancy,¹ and, so far as we are aware, not occurring in adult life. The disease is seen in two distinct forms, corresponding to the anatomical structure of the periosteum; in the one there is an acute inflammation, with pouring out of the inflammatory products between the surface of the bone and the deep fibrous layer of the periosteum (true, deep, sub-periosteal abscess); in the other the exudation takes place superficially to the deep fibrous layer, in the looser cellular zone which connects the periosteum with the surrounding cellular tissue (purulent abscess). The difference in location of these two layers is of the utmost importance, and is marked by striking differences in the course and results of the inflammation. While the sub-periosteal effusion, whether serous or purulent, lifts up the periosteum from the bone, presses upon and detaches the vessels passing to the Haversian canals, and thus cuts off the blood supply to the affected part, and further, by the extreme tension under which it is pent up, gives rise to all those evil results due to pressure of confined fluid, on the other hand, the superficial exudation, lying in loose tissue, interferes comparatively little with the blood supply to the bone, and is not bound down, so that there is but little tension.

Either form of acute periostitis may be met with as a result of injury, exposure to cold and wet, as a sequel of one of the exanthema,² or as a pyæmic condition. It will nearly always be found that one of these causes

¹ We have only twice seen it under ten years old. Warren Chayne mentions a case of Rasmussen's in which it occurred in adolescence; this was considered to be an osteomyelitis (epiphyseal).—*Brit. Med. Jour.*, March 3, 1899.

² Erysipelas and necrosis after typhoid do not occur till the patient is well of his fever (Chapt. Path. Liv. Typhoid fever). Macnamara, however, quotes Ashick's case of pyæmia in the third week of typhoid. We have seen a case of acute periostitis of the tibia following exposure to cold after influenza.

has produced, or at least preceded, the attack; often two or more may be combined. The disease is no doubt an infective one.

The onset of acute periostitis is marked by fever with its general constitutional disturbance, rigors, pain in the affected limb, with swelling coming on rapidly, and usually involving the whole length of the affected bone, and often the adjacent joints. Mr. Clinton Dent has pointed out that extension of suppuration to the joint is commoner in *supra* than in *sub*-periosteal abscess; it certainly does, however, occur in both forms. The skin soon becomes swollen, red, and shining, and there is extreme tenderness. The temperature commonly, in the *sub*-periosteal variety, reaches 103° - 105° , and there is much prostration. Soon the swelling increases, and, if proper treatment is not adopted, in a few days pus finds its way to the surface and is discharged, with much relief to the symptoms. Usually, however, fresh foci of suppuration arise, and, if the child is neglected, in a large number of instances pyæmia occurs, and the patient dies; in others, after much destruction of periosteum and the formation of many abscesses, the limb is left riddled with sinuses leading down to the bare dead shaft.

Sometimes, but not extremely, the neighbouring joints suppurate by direct extension from periosteum to capsule, and thence to synovial membrane; most often, however, there is merely a serous effusion, the result of interference with circulation, or a slight degree of inflammation.

Suppuration of a joint by direct extension might be expected to be most common in the case of the hip, where the epiphyseal line lies within the joint, and this complication does sometimes occur; it is not, however, common in our experience. Of twenty-three cases of acute periostitis under our care, the femur was affected alone in eight instances, the tibia was attacked in six cases (in two of these there was extension upwards to the femur), the humerus alone in two cases, the humerus and ulna in one, the radius in one, the tibia alone in one, the fibula in one, a rib in one, the ilium in one, and a metatarsal bone in one instance was inflamed. Five of these cases were *supra*-periosteal (genually) and in them no recovery followed. There were five deaths, all from pyæmia, and all in *sub*-periosteal cases; one child had non-purulent pericarditis (preceded by asperities) and recovered.

Usually the inflammation is limited by the attachment of the periosteum to the epiphyseal line, and does not reach beyond this; sometimes it spreads along this line and involves the shaft down its epiphysis, or sets up an osteomyelitis. The same endosteal lesions may, of course, result from extension upwards along the Haversian canals, but we think it is not the rule to find suppuration within the medulla, either epiphyseal or diaphyseal, as the result of acute periostitis. Quite apart from osteomyelitis, the whole shaft may necrose, probably because not only is the blood supply from the numerous small vessels entering the bone throughout its length cut off, but also because the nutrient artery itself as well as the supply from the epiphyseal cone is lost.

Mr. Macnamara, Mr. Tubby, and others believe that all these cases really begin as an inflammation of the epiphyseal line, and that the mischief spreads

Note Dent's also paper, *Med. Chir. Trans.* 1881. Mr. Dent believes that the medulla may disorganize without being affected at all. Vide also Mackenzie and Abbott, *St. Thomas's Hospital Reports*, 1886. *Brit. Med. Jour.* May 9, 1890.

downwards and upwards, both beneath the periosteum and in the medulla. Thus such a circulation does occur in their specimens proper, and we readily assent to our own experience, but that it is by any means the universal condition we cannot agree.

If left to itself, then, and the patient survives, acute periostitis soon is curious of a part or the whole of the shaft of the long bone into one subsequently new bone is thrown out by the surviving periosteum and surrounding tissues, and the sequestra are isolated in the sheath of this new bone, in which are those having done in the dead part.

Probably because the disease is a somewhat uncommon one, it is often mistaken, when it does occur, for erysipelas or dermatitis; most of the cases of necrosis resulting from it are said to have followed one or other of these diseases. From erysipelas it is distinguished by the much greater pain in periostitis, by the absence of any defined line of redness, by the limitation of the disease and its evident relation to the shaft of a long bone, and, as soon as an incision is made, by the exposure of the bone shaft.

There is, of course, no real resemblance to dermatitis of joints, inasmuch as the joints are only involved in very minor degree, so that this is a less excusable mistake. The disease most closely resembling it, especially the supra-priosteal form, is diffuse cellulitis; this, however, is usually more superficial and more widespread, not ceasing at the joints. In one case which we saw with Mr. Cooper, of Manchester, the mischief spread from the knee, and beyond this upwards to the lower end of the femur, but this is very exceptional: there was no suppuration in the femur. We have had another very similar case, vide p. 391, note.

There is but one treatment of acute periostitis at all worthy of consideration, and that is the incision down to the bone through the periosteum, as soon as the disease is diagnosed: each incision should be about one inch to two inches in length, and made in the long axis of the bone, care being taken, where practicable, to make the incisions not all on one side of the limb, though, of course, important vessels &c. must be avoided. Several shorter incisions are better than one the whole length of the limb, as Mr. Holmes has pointed out.

Excising is usually very free, and it may be necessary to plug the wounds

¹ Dr. Maunier is a recent paper in the *Annals of Surgery*, expresses disbelief in the existence of any bone-forming power in the periosteum, and believes that all new bone is formed from loose cells. His view is, however, not as yet accepted.



FIGURE. Acute Periostitis of the Femur, showing the progress of the disease, and the formation of the sequestra. The lower part of the shaft has been removed post mortem.

for a few hours, to arrest it; the plugs should then be removed, drainage tubes inserted, and the wounds dressed every day or two, or oftener if there is much discharge. Should no pus be found at the time of incision, provided that it is certain that the bone has been laid bare, it may be taken as a good that the disease is in its early stage, and the prospect is therefore better. In all cases, however, serum and flakes of lymph will be found, even if there is no pus, and there will usually be free suppuration in a short time. Too free exploration of the bone with the finger or probe, and too frequent or forcible syringing, are to be avoided, as tending to separate any still adhering periosteum, or to prevent adhesion after separation has occurred. The limb should be kept slightly raised, and stimulants, opium, and abundant nourishment given to the child. Should the fever not subside in a few hours, it is probable that some abscess has not been relieved, and a diathermic should be passed round the bone, or a fresh incision made at any painful spot. In the tibia, for instance, where incisions can hardly be made at the back, pus may be lying beneath the periosteum at the back of the bone, bound down by muscular attachments. In spite of the authority by which it is supported (Billroth), we cannot regard applications of nitrate of silver or iodine, or anything except free incision, as good treatment.

Since such extensive necrosis and so much suppuration with liability to pyæmia often follow in these cases, it has been proposed to open the affected bone at the time of incision, and this has been done by various surgeons. Since the periosteum is preserved, a new bone is developed, and, it is said, without shortening in cases where a second bone exists, as in the leg and femur.¹ We cannot say we see any great advantage in this method, and it is impossible in any case to be sure how much of the bare bone will die—usually it is only a very small portion composed with the part exposed; and though we have in a later stage removed nearly the whole of the shaft of some of the long bones as sequestra, it is common to see quite small pieces of dead bone as the result of most extensive stripping off of periosteum. We believe that much harm is often done by the practice, already alluded to, of passing in the finger, sweeping it all over the bone, and then remarking that the whole bone is bare; of course it is, for the operator has just stripped off the remaining periosteal attachments. We think, therefore, that primary resection of the diaphysis is not to be recommended unless it is absolutely detached at each epiphyseal junction and bare of periosteum throughout—a very rare condition. Neighbouring joints should not be opened unless they are pretty clearly suppurating, i.e. a slight degree of effusion does not mean suppuration. If the joint is full of fluid, and the skin over it is hot and its veins torpid, or if the swelling does not subside rapidly after incision of the periosteum, the joint should be opened or, if in doubt, aspirated; if pus is found, a free incision and the insertion of a drainage tube are required.

It must be very rarely that immediate amputation is demanded, even if joints are involved; if there is no pyæmia, a large proportion of the cases do well, and if pyæmia exists already amputation will not usually succeed.

¹ Much shortening has, however, followed in some cases *loc. cit.* Nere, *Archiv Med.* (Jan. April 1884), now records a case of an inch and a half shortening after removal of the upper half of the tibia; also Robinson, *Surg. Jiv. of Children*.

If after free incisions the symptoms do not subside, and especially if pus escapes from the epiphyseal line, there is probably suppurative osteomyelitis; the bone should then be exposed and trephined to give vent to the matter.

The time at which sequestra may be expected to be loose after the onset of the disease varies with the size of the bone and the extent of destruction; if the whole shaft dies the bone will probably be loose in a month or six weeks; if only a part is necrosed it will vary from the time mentioned to many months, or, in the case of the femur, the bone, especially if the lower end is affected, may remain for years without being detached, and yet is so far devascularised that it acts as a foreign body and keeps up suppuration. This especially applies to periostitis attacking the popliteal surface of the femur, and holds good of chronic inflammation as well as acute.

No absolute rule, then, can be laid down as to the time at which sequestra can be removed; the sinuses should be explored with a probe from time to time, and if the dead part can be felt to be movable it should be cut down upon and taken away. If no loose bone can be felt, but the probe passes down through sinuses in the new bone to a sequestrum, the patient should be anaesthetised, the limb rendered bloodless, the sinuses laid open, the sinuses enlarged, and the sequestra examined: any that are loose should be taken away, and any distinctly dead but not loose bone may be cut away, but no doubtful bone should be disturbed—it may recover. The wounds are then plugged with iodoform gauze or lint, and daily dressed until they fill up or the sequestra become loose. It is very seldom that all the dead bone is removed at one operation; usually small fragments either come away of themselves or have to be removed by later operations. In clearing out the cavities in which sequestra lie great care should be taken not to break joints or remove more new bone than is necessary. The delay is waiting for the separation of sequestra is not wasted time, for the new bone is meanwhile consolidating and the limb getting stronger. In subsequent dressings care must be taken to keep all the cavities well drained and syringed out, otherwise retention of discharges and detritus will give trouble. Unnecessary probing of sinuses is useless and harmful; it is useless to be constantly feeling bone to see whether it is loose, for the process of separation is a slow one; it is harmful, because broken granulations readily absorb septic material, while sound ones are proof against it—moreover, it needlessly frightens a child. Where repair is very slow, and profuse discharge is wearing out the patient, it may be necessary to sacrifice doubtful bone for the sake of rapid healing, or even in extreme cases, chiefly where there is destruction of a neighbouring joint and great prostration, amputation may be required.

CASE.—T. B., aged 6½ years, was admitted April 21, 1881. Three weeks previously the boy fell down some steps and hurt his forehead and his shin, but seemed to get quite well. Two days before admission he complained of pain in the left thigh, but not about as usual. On the following morning he could not get up, had pain in the knee, and could not move the leg; he was delirious during the night, with profuse sweating. On admission he was pale, chill, and fever-looking; respiration 24, temperature 101½, pulse 116, with low, muttering delirium. He was ordered four grains of quinine and brandy-and-egg mixtures. The left thigh was swollen to nearly double its normal size from the top to the knee, and intensely painful. A short time after he came in, there was

incision were made through the periosteum down to the bone; much union sero-pur and lymph escaped. The bone was quite bare. After the operation the temperature was 102° falling to 101½°. There was great prostration. The temperature again rose to 103° at 11 P.M., when he died.

Post-mortem.—There were acute pyæmic abscesses in the lungs, and the whole femur was laid bare from the neck to the lower epiphysis. No other disease was found. *Plate fig. 172.*

Supra-periosteal abscess has the same general symptoms as the more serious conditions, but it is much less severe, for the reasons already mentioned; the pain and fever are less, though the swelling is often as great. On cutting into the abscess, and passing the finger in, the bone will be found still covered with the dense fibrous layer, and is consequently not bare. Necrosis seldom follows, or if it does it is limited both in extent and depth: usually only a small scale of bone comes away. If this form of periostitis is, however, neglected, the deeper layer may slough, or the mischief spread through it, and more extensive necrosis may ensue. The diagnosis between the two conditions can generally be made by the less severity of the symptoms in the superficial variety.

The immediate and later treatment is the same as that of the sub-periosteal form, i.e. free incisions at first, and subsequent removal of sequestra, should any necrosis occur.

Case.—*Supra-periosteal Abscess of Thigh*.—MARY ANN D., age 13 years 8 months; admitted December 24, 1872. Three weeks before admission she had pain about the lower part of the leg and swollen knee; the symptoms increased hourly, and the left thigh was forced to be swollen and aching; she had been getting thin and pale for two or three months previously; no injury. On admission a large fluctuating swelling occupied the anterior and upper half of the left thigh, large contumacious over the surface, there was a blush of redness over it, and some tenderness and pain; an incision was made into the swelling, and a large quantity of pus escaped, which was in close contact with the bone, though the latter was dreadfully bare; considerable bleeding took place into the abscess cavity, which stopped after a free counter-opening and more perfect drainage were employed; she then slowly improved, and was discharged well on August 2. This case did not come under our care at first, and it was only at the second examination that we had an opportunity of exploring the bone; at this time it was certainly not bare, a thin layer (deeper layer) of periosteum covering the bone. The constitutional disturbance, so usually occurs in the superficial periosteal abscess, was much less than in the sub-periosteal form, and no necrosis followed.

A careful watch should be kept for the onset of pyæmia in all cases of acute periostitis: it appears sometimes exceedingly rapidly. We have just mentioned a case of acute periostitis of the femur, which died with infarcts in the lungs and ecchymoses on the pleura after an illness of altogether only two days, and another child died in the same way six days after an injury giving rise to periostitis of the fifth metatarsal bone.

In some instances the periostitis is multiple at the first: these cases are in doubt pyæmic, and sometimes occur after a primary joint lesion; thus we have seen acute suppuration in the ankle followed shortly by an abscess in the wrist, and a few days later by periostitis of the humerus and ulna, and by pneumonia. After death no other lesions than these were found. In another case, of an infant six months old, periostitis of the tibia followed a suppurating sarcoma of the scalp: the bone necrosed and gave way, a fracture resulting; the child died of pyæmia, sinking, as they so often do, quite suddenly.

We have seen a case of pyæmic necrosis of the radius in which the lesion was close above the lower epiphyseal line, but there was no shortening of the bone four or five years after. The patient was under the care of my friend Dr. Sellers, of Rochdale.

The disease very rarely attacks any bones except the long bones of the limbs; the tibia, femur, humerus, and ulna we have seen most frequently affected—sometimes the whole shaft, in other instances only a part, being laid bare. Occasionally the short and flat bones are attacked (*vide* T. Jones, 'Diseases of Bones,' p. 90).

A case of acute periostitis of a vertebra is mentioned by Macnamara, and *vide* note, p. 291.

CASE.—*YOUNG* of *RED MAINTAIL*. *Ætiology*.—Wm. G., age 40 years, farmer, died Nov. 20, 1871. Nineteen days before admission, fell with his side against the dashboard, and since then had much pain in the side, and vomiting appeared every day, first green, and now brown, and continued on November 20. On admission pale, some dyspnoea, but no urgent anxious expression; a soft fluttering swelling over the lower part of the left side of the chest, rather larger than the palm of the hand; the heart's impulse was two or three inches to the right of the sternum, and the whole of the left side of the chest was dull, and the respiratory sounds were bronch, though rattles; a systematic morning showed distinct bulging of the left side. The stomach was empty the same day, and a small quantity of thin gas escaped; the pleural cavity was also empty, and a pair of drawing forceps pushed into it between the chest and a large quantity of slightly livid yellowish fluid was evacuated, the stomach cavity was clearly made distinct from the pleura, and at that time the pleuritic fluid was not completely the same size, but was fractured; a trephine was then used into the chest and the second found satisfactory. All went well, and on December 3 a valuable tube was introduced for the chest machinery rule. On the following day it was seen that for the first time the discharge was bloody, persistent, and it was considerable in amount; the lower half of the left chest below was with dull and tender to percussion, though in front the resonance was good. A few days later there was still partial collapse; a week later another thoracic incision was made, and the free opening appeared, and on testing it, rats lungs were felt; the hollows lay out clearing up. By the end of January 1872, the discharge from the chest had become as the tubercle nearly disappeared. On February 2 an incision was made over the dorsal rib, and about a third of it removed; there was a good deal of new bone around the incision; the cavity left was plugged with a piece of sponge, which remained in place till March 10, when some of it was cut away; several bleeding points in it then occurred, and a granulation which had spread into it and held it firmly in position; it was then the left lung was removed, except a little below. On March 12 an incision was discontinued, as the work more of the sponge was cut away, and at the end of the week the rib was removed; it was found that it was impossible holding and raising erosion of the edges; the sponge was filled with granulation tissue, which microscopically was seen to protect the exposed sponge landmark. The wound regains itself, and on May 1 he was discharged almost well, there was little if any retraction of the ribs, and the lung had apparently fully expanded. These traumatic perforations of the rib led to direct anæmic and serious effusion into the pleural cavity, after the opening was made probably the suppuration in the thin cavity resulted from the communication with the external air.

Arrest of growth from destruction or synostosis of the epiphyseal line may result; or, on the other hand, there may be overgrowth from persistent hyperæmia of the limb, as the result of the subsequent irritation caused by

¹ J. H. Morgan has detailed a case in the *Brit. Med. Jour.*, September 1, 1872. The humerus was the bone affected. *Étude* also Talbot, *Lancet*, June 6, 1872.

sequestra (fig. 118). This overgrowth may, as seen in the figure, cause distortion from one bone of the limb outgrowing the other.¹ Occasionally sinapisms occur many years after the original disease has subsided, and abscesses form, and sequestra are separated in middle life. We have several times met with these cases of 'relapsed necrosis.'

Where the periosteum has extensively sloughed, or where the bone has been fractured, a short, weak limb may result from deficient development of new bone; these fractures sometimes remain ununited, and may require resection and wiring.

CASE.—New Disease of Tibia after Fracture as Result of Necrosis.—Female, age 1 year 5 months; two months ago left hospital, after osteomyelitis, in a plaster bandage; no union occurred, and limb was useless and quite movable, though not stiffly; incision made down arm with all bones which were much attended, ulnae resected and wired together by one suture, which was fixed to button on surface of wound, ulnae fully union recovered, and child could bear her weight upon her leg and walk well.

As the accounts of different writers on the subject of acute bone inflammation are somewhat conflicting, and give rise to confusion, the accompanying tabular statement of how the different lesions may arise will perhaps be of service to those less familiar with bone diseases.

Acute inflammation of bone may begin at:

A. Periosteum.

1. Sub-periosteal.
2. Supra-periosteal or Parosteal.

B. Osteomyelitis.

1. Epiphysitis, i.e. disease beginning in the cancellous tissue of the epiphysis.
2. Inflammation of the medulla of the shaft (diaphysitis).
3. Inflammation beginning in the epiphyseal line, often called epiphysitis also.

Inflammation arising in any of these ways may give rise to the other forms of lesion; e.g. sub-periosteal abscess may spread along the epiphyseal line and cause suppuration in the medulla of the shaft, or inflammation of the medulla may spread outwards and cause periostitis. As a rule, however, careful clinical observation will enable an accurate opinion to be given of the primary seat of the mischief.



Fig. 118.—Shows Comparison of the bones of the Right Leg, especially the Tibia, after Necrosis (St. Mark's Case.)

¹ Herbert has recorded a case of overgrowth of a limb after injury to the patella in a boy of eight years (*Path. Soc. Trans.* vol. xxiii.); vide also Edmunds, *Path. Soc. Trans.* vol. xlii. A case of H. Pollard's, described as hyperostosis, is perhaps of the same nature.

Chronic Periostitis.—Periostitis of less severity, and less rapid in progress, is common enough, and the subacute cases are better classed with the chronic than with the acute, inasmuch as they are more like the former than the latter in their results. Subacute or chronic periostitis then occurs in children as the result of injury, as a pyæmic condition, or as the sequel of an exanthem—probably these two sets of cases are very closely allied, if not identical; or it may be caused by syphilis or tubercle. Whichever of these is the cause in any individual case, suppuration often takes place except in traumatic and in many of the syphilitic cases. Since the process is a slow one, it is usually impossible to say whether the lesion began as a sub- or supra-periosteal inflammation; perhaps the whole thickness of the membrane is involved at once, or else, as the bone is usually more or less deeply implicated, the lesion is sub-periosteal in origin.

The disease is characterised by local or diffused thickening of the bone in its early stages; the swelling is tender, painful at times, but usually, unless in subacute cases, there is no implication of the skin. Later on, the swelling, if left to itself, either subsides or softens down, and abscesses form in one or more spots; on incising these the bone is found bare and rough, with perhaps small scale-like exfoliations, or in other cases, to be described presently, more extensive lesions. The periosteum is sometimes four or five times its usual thickness and readily peels off the bone, while in old cases there is often some rough spiny deposit of new bone developed around the centre of disease. In traumatic cases in healthy subjects the thickening may subside altogether without any trouble or suppuration, or there may be sufficient new bone formation to cause swelling lasting for months or years without any other symptom.

In tubercular children the swelling ("tumourous periosteal node") usually slowly increases, often painlessly, though by no means always so; suppuration finally occurs and matter is discharged, or in rarer instances the inflammation subsides. Generally in the tubercular cases periostitis is either the result of, or itself leads on to, osteomyelitis. (Superficial or central cases.)

Exanthematous periostitis is found usually in wasted and feeble children, either in the course of, or as a sequel to, one of the specific fevers; there is often much suppuration, with but little pain or disturbance, and a flask is found occasionally to be little more than a flabby bag of pus, without any pain and without much fever. The child lies wasted and haggard, with rough scaly skin and offensive smell, the hair harsh and often thin, and the veins showing distinctly through the thin, fatless skin. The chronic pyæmic cases or exactly resemble these that it is probable that many of the exanthematous forms are really pyæmic. A fair number of such children recover, others gradually sink of exhaustion or some intercurrent pneumonia or dysentery. Much less severe cases are also met with, in which chronic periostitis occurs affecting only a small part of a bone—it may be any bone—and either subsiding or giving rise to only local necrosis; the ribs are said to be specially often attacked after typhoid fever, but seldom otherwise. For an excellent account of these diseases read T. Jones on 'Diseases of the Bones,' (1887, p. 49) (vide also chapter on SPINAL DISEASE, *infra*, p. 620, for a more of section of a spinous process).

Congenital syphilitic periostitis is usually multiple, and occurs rarely

during the first year or two of life, being commonest from about the 5th to the 12th year. It is, as Hutchinson has pointed out, less amenable to anti-syphilitic treatment than the periostitis of acquired syphilis, and according to him is commoner in the upper limbs; in our experience symmetrical periostitis of the shafts of the tibia ('syphilitic nodes') is far the commonest form, and in some cases it breaks down and large ulcers form on the surface. The amount of thickening may be enormous, as in fig. 119.

CASE.—*Congenital Syphilitic Periostitis of Tibia*.—Lilian G., age 12 years, admitted November 19, 1884. Mother had three miscarriages at the onset of her third pregnancy. Patient when born had an eruption about the face, neck, arms round the neck, and nostrils; improved at six months old, and has gone on well since, except for a sore eye. Duration, three years, following a slight kick; no swelling till a month later; much pain now when leg has been under treatment (antisyphilitic) as an outpatient for some considerable time. On admission, healthy-looking girl; teeth normal; no obvious signs of syphilis; the right tibia is much thickened, and apparently bowed across posteriorly; no fluctuation; the most tender spot is on the front of the lower part of the middle third; the swelling involves nearly the whole shaft; no fever. November 27, this enlarged of its most painful spot; periosteum much thickened; the bone was much sclerosed and the medullary cavity reduced to a narrow channel; no pus and no cavity found. The affected periosteum was stitched together with cotton and tube inserted. Operation aseptic. All went well; she was discharged on December 19; there was no further pain, and when seen at an outpatient, February 1885, she was sound and well, and free from pain.

CASE.—*Syphilitic Periostitis of Tibia*.—John Wm. A., age 6 years. No tubercular history; one of the children died of convulsions 14 seven weeks ago had trachea; three other children living; no miscarriages. Child healthy at birth, weaned when three years old; the leg has been tender for six months, but no swelling was noted till five days ago; no pain unless touched. On admission, pale, unhealthy child; has venous or double convulsions; lettings and waxes at the angle of the mouth; the upper milk incisors have gone, lower incisors small and ill formed; there is thickening, forming a prominent swelling in the middle of both shins, tender but not red. The tenderness disappeared quickly under treatment (antisyphilitic), the swelling remaining much the same.



Fig. 119.—*Congenital Syphilitic Disease of Tibia* (posterior and anterior). The figure, from a patient of our own, is reproduced from Mr. Jones's book.

Less frequently the upper end of the tibia is involved; in such cases there is not rarely effusion into the knee, not merely passive, but an actual stroma synovialis. Other evidence of congenital syphilis is in our experience almost always to be found, though it is not always obvious. The pain is

often severe, though sometimes it is almost absent.* Macnamara believes that the syphilitic telostosis of infants (see chapter on CONGENITAL SYPHILIS) is due to interference with nutrition at the epiphyseal line from pressure of new formed perosteal deposit around, and that the telostosis is not inflammatory.† Arrest of growth may result just as in the case of older children who are attacked by syphilitic epiphysitis (now EPIPHYSITES). The plates and bones of the face are not rarely destroyed by congenital syphilis, but this occurs in a late stage of the disease (vide fig. 84); the nasal bones are, of course, early affected, and the deformity resulting gives rise to one of the characteristic features of inherited syphilis. The evidence afforded by thickening of the bone, with tenderness on deep pressure and aching pain, serves to distinguish periostitis generally from any more superficial lesion, while the onset of swelling and pain simultaneously points to the existence of periostitis rather than osteomyelitis, though either, it must be remembered, may give rise to the other. New growths are to be distinguished by their greater rarity, their greater prominence, with often beaves and a well-defined margin, and local patches of softening, as well as by their situation, which is usually at the ends of the bones; hence they are more likely to be mistaken for osteomyelitis than for periostitis.

The tubercular and syphilitic lesions are nearly always accompanied by other evidences of their respective diseases, such as tuberculous glands or ulcers, a family history of tubercle, or, on the other hand, syphilitic lesions of the eyes, teeth, &c.†

There is difficulty sometimes in distinguishing the lesions of bone due to congenital syphilis from those dependent upon tuberculosis, though we are not inclined to think that the mistake is so often made as *Fournier*‡ would have us suppose. As already mentioned, the tibia is (as *Fournier* also points out) the bone most commonly affected by the syphilitic lesions, and the long bones are more often attacked than the short or flat bones, with, perhaps, the exception of the skull, while the diaphysis is more liable to be attacked by syphilis than the epiphyses. New bone formation, severe pain, worse at night, little tendency to suppuration, though occasionally abscess and necrosis do occur, and evidences of syphilis from the history or presence of other syphilitic lesions, are the principal features of the one group, while the tuberculous cases are characterised by absence of any new bone formation, cancer occurring rather than necrosis, by early suppuration, freedom from pain, and the other features already pointed out. The effects of treatment by iodide of potassium will give confirmatory evidence. In any case of doubt antisyphilitic treatment should be given a fair trial, it being remembered that children bear, and often require, large doses of iodide (gr. x-xx) to obtain good results. Nearly all the varieties of

* Mr. Moellin has written a good paper on this subject in the *Arch. Med. Sci.*, 1884.

† 48.

‡ *Brit. Med. Jour.*, July 1, 1884.

Butcher, *London Hospital Reports*, vol. ii.

§ Dr. Goodhart has met with a remarkable case of bone disease in a child a year old, which was thought to bear relation to congenital syphilis, but was probably syphilitic; there were tenderness, swelling, and diffuse thickening of the bone; tibia involved.—*Funk. Soc. Trans.*, vol. lxxv.

¶ *La Syphilis Médicovet. Française*, Paris, 1885. To this work we must refer for an elaborate account of the later forms of hereditary syphilis.

periodontitis are found chiefly in the long bones, though similar lesions may be met with elsewhere, as in the jaws, &c.; (vide chapter on DISEASES OF THE MOUTH, and also the chapter on JOINTS.)

Treatment.—In early stages of the disease, if the leg is affected the child should be kept in bed with a splint on. Cod liver oil and iron should be given in the tuberculous, hydrarg. c. croch or iodide of potassium in the syphilitic cases; the former in children one or two years old, and a combination of the mercury and iodide in older cases being the best treatment. Where the arm is affected, a splint should be applied and the child allowed to be up, unless any serious mischief is going on. Simple traumatic cases require rest and the application of soothing agents, such as lead, with or without spirit of opium, or the application of belladonna diluted with glycerine or vasoline; in some cases good is done by rubbing in mercurial ointment, or better, ung. hydrarg. oleat. 5 or 10 per cent., or keeping it applied over the swelling. Some surgeons have faith in the application of iodine; a blism sometimes undoubtedly of use in relieving pain. If after a fair trial of some weeks no good result has been obtained by these means, and pain still persists, or, of course, earlier than this if suppuration occurs, an incision should be made down upon the bone through the periosteum; if pus is found, or any superficial necrosis, the case is to be treated on ordinary principles; if after this the pain is not relieved or remains, it may be taken for certain that osteomyelitis exists, either as a primary or secondary condition, and this should specially be borne in mind in tubercular cases in which osteomyelitis is much more commonly the primary lesion in long bones. If then there is evidence of osteomyelitis, further measures will be required (vide pp. 604 *et seq.*).

Occasionally in syphilitic cases no absorption takes place under mercurial or iodide treatment; if the pain persists, the bone should be cut down upon and, if necessary, rephased or gouged, so as to open up the sclerosed bone and give vent to any pent-up material (cf. case, p. 599, *infra*). In cases of syphilitic necrosis of the bones of the face or palate a plastic operation may be required, but this should not be attempted until the destructive process has entirely ceased. Where the whole hard palate has been destroyed an obturator may be necessary. We have seen a case where, after ulceration of the palate and pharynx, the soft palate became adherent to the pharyngeal wall, and the obstruction to the nose thus produced caused so much trouble that excision of part of the soft palate became necessary. 'Periodontitis alba' is a name given to a form of periodontitis in which there is effusion of non-purulent fluid beneath the periosteum. There may or may not be necrosis. There is no hard-and-fast line to be drawn between these cases and chronic purulent periodontitis; the exact nature of the effusion may in our experience vary from serum to solid lymph on the one hand or pus on the other; a similar variation occurs in the case of the effusion in central inflammation. We have found the medulla replaced by masses of curd-like lymph with little or no pus.

Acute Osteomyelitis.—Acute diffuse infective osteomyelitis occurs usually as a result of amputations or resections, but is rare in this country; it is, however, more common in hot climates. The disease is, however, now most often met with as a result of extension to the medulla of inflammation

beginning in the epiphysis or epiphyseal line, or of acute periostitis, and occasionally occurs as a primary condition. Mr. Macnamara, and with him some of the continental surgeons as already mentioned, believe that the affection already described as acute periostitis is really acute osteomyelitis; this, however, is, we believe, not the case as a rule, since if it were so complete recovery in these cases without extensive sequestrations would not be nearly so common as it is. Moreover, in cases of acute periostitis dying of pyæmia sections of the bone have shown an entire absence of osteomyelitis in some instances.

The characteristic symptoms, in a case where acute osteomyelitis follows amputation, are swelling and subsequent supuration of the medulla, resorption of the periosteum and soft parts, so that the bone is left bare, and diffuse swelling of the limb. Pyæmia usually rapidly ensues, and in many cases death speedily results. Amputation at the joint above has been usually said to be the only successful method of treatment, but the plan introduced of scraping out the entire contents of the medullary canal, as advocated by Mr. Keely and others, is well worthy of adoption, and has proved successful in several instances; our colleague Mr. T. Jones, among others, has had good results from this method.

Where acute diffuse osteomyelitis occurs as a sequel to epiphysitis or periostitis, or is the primary lesion, the shaft of the affected bone should be freely opened with trephine or chisel, and a similar treatment adopted. The existence of this disease may be suspected, as already pointed out, when the severe constitutional symptoms and pain do not subside after freely incising the periosteum or opening up an epiphysal abscess; swelling and tenderness at one or more points in the shaft, or diffuse bony swelling without any collection of fluid beneath the periosteum, will indicate the presence of pus in the medulla. For an excellent account of the whole question *vide* 'Diseases of the Bones,' by T. Jones, 1837.

Acute Epiphysitis.—Acute circumscribed osteomyelitis or acute epiphysitis is a more common condition; it consists in a localised inflammation attacking the cancellous tissue of an epiphysis or the immediate neighbourhood of the epiphyseal line. The disease usually always goes on to suppuration, and on examination a cavity will be found containing pus, or in some cases sequestra. Acute epiphysitis may occur in children of any age; for instance, most cases of 'acute suppurative arthritis of infancy' are typical examples of this disease (*vide* p. 622); in other, though much rarer, instances older children are attacked.¹

If left to itself, the pus finds its way either into the adjacent joint or along the epiphyseal line to the surface (the epiphysis may in this way become detached from the shaft), or down the medulla of the shaft, giving rise to acute diffuse osteomyelitis. The disease may follow an injury or exposure, or one of the exanthems, or, according to Mr. Greig Smith, may arise from lymphatic infection of the bone marrow. It most commonly attacks the head of the femur, the upper end of the tibia, or the lower end of the femur, less often the extremities of other long bones. Some of the cases of acute disease of the hip, elbow, shoulder, and ankle, apart from 'acute suppurative arthritis of infants,' are really also of this nature.

¹ *Vide Abstracts of Cases recorded at Children's Hospital, Fenchurch, 1876.*

The lesion is marked by early fever and much pain,¹ of gnawing, tooth-ache-like character, followed, after a longer or shorter time, according to the age of the patient and the amount of resistance to the exit of the pus, by swelling of the bone coverings and effusion into the adjacent joint, which is usually kept fixed in the position of least tension. We have, however, seen the knee strained to its utmost degree of flexion, far beyond the point of least tension; thus showing us once that the lesion could not be intra-articular.

The pain is usually agonising, and the failure of health very rapid. Deep pressure in the earlier stages, and any touch of the limb when the pus is approaching the surface, is exceedingly painful. Local heat is usually only appreciable in the later stages; increased pulsation in the main artery of the limb may be found. In infantile arthritis (acute suppurative arthritis) the symptoms are sometimes tubercle. The diagnosis is made by careful exclusion of joint lesions (by lack of marked effusion, &c.), where the joint is still free, and attention to the history of the pain and swelling, so as to distinguish the case from peritonitis, though, of course, as pointed out by Murchison and others, and as already described, epiphytitis may give rise to sub-peritoneal abscess and necrosis as well as to intra-articular abscess; pus on deep pressure in the absence of joint disease is a characteristic feature. Rheumatism and rickets pain are readily distinguished by the strict localisation of the suffering. In the infantile cases the joint is usually swollen by the time the child is brought.

CASE.—Hæm in the Head of the Tibia.—Wm. H., B., age 9 years; admitted December 25, 1881. Had pain in the leg for two months; worse for five days; no fever the history. On admission he was pale, ill, and anxious. Temperature 101.5°; there was intense pain in the right knee, which was fixed to its fullest extent; there was no effusion in the joint, and the cartilages of the condyles were distinct through the tightly swollen skin. Over the head of the tibia and the upper third of the leg there was considerable swelling, most marked over the inner tubercle of the tibia, where also the tenderness was greatest; no fluctuation; under chloroform an incision was made over the inner tubercle, and the soft parts found infiltrated with inflammatory products, but no pus; a thick indurated line of union of epiphysis and diaphysis was seen, and no gnawing or any bone about the st. of thick unresisting cartilage; no distinct cavity was found; operation attempted; a tube was put into the opening in the bone; one hour after the temperature was 100°. He had pain on several evenings subsequently, and there was but little or no purulent discharge for two days, when several drachms of pus were discharged. On January 5, as the joint was swollen, it was aspirated, and a small quantity of turbid viscous fluid withdrawn and as we lay applied; he had no pain afterwards. In the with the joint began again to swell, and on the right was distended, and no effort was made into it, discharging fluid at first fishy, but soon, and subsequently more viscid purulent. On February 9 the drainage tubes were removed and all was going on well, the wounds in the joint being superficial, though bone could be felt through the opening into the tibia; the limb had been kept fixed. On the 24th the joint was freely flexed and several adhesions broken down; considerable swelling followed; the joint shortly swelled down again. March 5, a small sequestrum was removed from the tibia; it will be a good deal of spongy material. April 3, the limb was put up in plaster of Paris, and the boy went out on the 9th. He attended us on one patient subsequently; several swellings of bone came away, but the wound finally closed, and he has now, February 1882, a sound limb with a fully movable knee, though a little thickening still remains.

¹ In the infantile cases we have, of course, no means of knowing the kind of pain, but usually it is extremely severe.

The treatment of acute epiphysitis consists in early and free incision down to the bone: if matter is near with, this is usually sufficient, but, should the pus not have reached the surface, an opening must be at once made into the bone and the abscess emptied, any sequestra found being removed. In any doubtful case it is far better to explore the bone than to run the risk of the abscess bursting into the adjacent joint. Should the joint be already involved, as it almost always is in the acute epiphysitis of infants, it must be freely opened and drained. For a more detailed account of infantile epiphysitis, see the chapter on *TUMORS OF THE JOINTS*, p. 612. Messrs. Fish and Page have recently called attention again to those cases which have been described above, and discussed both in former editions of this book and elsewhere.

Should the mischief have spread to the medulla of the shaft, the diaphysis should be exposed and trephined at one or more spots to give vent to the pus, and the whole medullary cavity should be scraped out, washed, and drained; failing this, amputation is the last resource. For some good cases illustrating this treatment, vide T. Jones on '*Diseases of the Bones*' 1885, and '*Medical Chronicle*,' Dec., 1886.

A condition known as '**Growing Fever**' is sometimes met with, mainly in children of from seven to fifteen years, though occasionally at both earlier and later ages. The main features are pain in the region of the epiphyseal lines, rapid growth and fever sometimes, with considerable constitutional disturbance. Usually the symptoms pass off without any bad result, but in rare cases osteomyelitis may be set up, and the development of tumours about the epiphyseal lines has also been noticed after the occurrence of 'growing fever' (vide '*British Medical Journal*,' April 14, 1900, p. 820).

Chronic Circumscribed Osteomyelitis.—Where chronic osteomyelitis is localised, as, for instance, sometimes in the epiphyseal extremities of the long bones, an abscess may result, with or without necrosis; the symptoms are those of acute epiphysitis, already described, only less severe, and the onset of the disease is slower and more insidious. In non-tubercular cases there is often much sclerosis of bone around the abscess cavity, and the disease may go on for years without any attempt at reaching the surface. In other instances the extension of the inflammation to the surface is marked by slight and slowly increasing thickening of the periosteum, so that the diameter of the bone is somewhat increased, and the tissues over it may be slightly indurated. The characteristic aching, gnawing pain, especially at night, is sometimes well marked, but in children more often there is comparatively little pain, and the pus some finds its way to the surface—both these facts being due, no doubt, to the less resisting nature of the lighter bones of children. Hence the more typical features of chronic circumscribed abscess of bone are comparatively seldom seen in young children, but are most marked in young adults. Moreover, in children the distinction between circumscribed and diffuse osteomyelitis is also less defined; though sclerosis of the walls of the cavity does sometimes occur, it is less frequent in children, and the inflammation is more apt to become diffuse. The attacks of pain may be inconsistent, so that for weeks or months there is little sign of anything wrong, and then all the symptoms appear.

CASE.—Etiology of both femora, &c.—John W., age 5; admitted April 22, 1884. Most delicate; his eighth month just had abscess; twelve months ago had fever; eight months ago had measles; four months ago knee swollen painfully, was put to bed and speedily recovered. On admission, delicate child; abscess scars about neck, &c. Scar on left upper arm leading to knee lesion. Just above right knee is a scar and some more at point of scar, another below the knee; at lower third of leg is a large abscess; scar on distal left knee with abscess on leg and knee somewhat well, some scar for a while. Re-admitted May 12. Femur explored, and knee joint felt at back of right knee and in arm. Femur, under abscess. Left thigh explored through incision on outer side; on bare bone felt, and posterior triangular space was healthy, but bone was exposed, at a similar opening was made with gauge and deep in the centre of the bone was found a cavity containing purulent material and some blood. On May 22, the size of the head of the thumb was felt with abscess well. On the right side femur was felt behind, and above the normal contour; a gradually smaller abscess was done, and just the same solution found together with several small abscesses. This cavity communicated by a constant course with the cavity of the bone also; this cavity, however, in opening into the bone, required some force to move out from the bone. It was syringed out with chloride of zinc and filled with iodine. Some abscesses continued, but did not get out to a certain point and was discharged by it. He was subsequently recovered with the abscess in the right thigh healing, and was still under treatment in May. He is now healthy.



FIG. 100.—Exposure of the upper end of the right femur, with abscess and reference to the ligament of the femoral foramen. The bone cavity was not exposed.

Abscess in bone is not limited to childhood, but very frequently begins before puberty, though many of these patients do not come under treatment until the disease is of long standing. Though most commonly met with in the cancellous tissue of the extremities of the long bones, abscess may also occur in the shaft, and we have more than once had to trephine for circumscribed abscess in the middle of the shaft (of the femur or tibia) occurring many years after an attack of acute periostitis.

Treatment.—As in acute periostitis, there is but one thing to be done in these cases. A free incision should at once be made down upon the bone, and either with a gouge or trephine, a hole made into the cancellous tissue until the abscess is reached. Before operating the exact spot of greatest tenderness should be marked, and this is to be the centre of the incision. We have derived great help from this precaution in finding a small abscess

in bone. Some surgeons prefer to do linear osteotomy, i.e. saw across the epiphysis with a fine saw, and thus open up the abscess; but this plan is in no way better than the other. The bone is usually found soft, red, and rarefied; when only a drop or two of pus will escape, and this may be overlooked. Even if the abscess is not found, relief is almost sure to follow, and pus will be discharged in a day or two; at the same time, if an abscess is found, careful exploration should be made in every direction for the matter, to diminish the risk of its opening into the joint. Should a sequestrum be found, it will be of course removed, and the cavity should be well scraped out and drained; should the adjacent joint be involved, it must be treated like any other suppurating joint.¹

Chronic Diffuse Osteomyelitis.—This disease is met with chiefly as a tubercular or as a pyæmic condition; it may result from extension from a primary periostitis, or originate in the medulla, perhaps most often beginning in the epiphyseal line. It is a matter of extreme difficulty, and sometimes impossible, to be sure whether a green lesion has begun as a local periostitis, spreading afterwards to the epiphyseal line, or whether the epiphyseal lesion is primary and the periostitis secondary.

The tubercular disease in a well marked case is a remarkable lesion; the child has perhaps a history of some long continued bone trouble coming on after measles or other illness, or after an injury; external examination shows thickening of a large part of a long bone, with a sinus leading down to a cavity in the shaft. At first sight it appears that the case is one in which either the periostitis is the main lesion, or a small localised central inflammation has reached the surface and then spread along the periosteum; but on cutting down upon the cavity, and clearing it out, a small sequestrum, infiltrated with pus, and greenish-yellow in colour, is removed. Instead, then, of finding the walls of this cavity formed of healthy but sclerosed bone, they are soft and also infiltrated with pus, showing the same greenish colour as the sequestrum. There is no sharp line of demarcation between the green bone and the surrounding shaft, but patches of mottled pale bone are seen in parts. On attempting to gouge away the diseased tissue it will often be found to extend throughout a great part of the shaft, and perhaps several inches of cancellous tissue are thus removed before living bone is reached. When all has been removed the cavity slowly fills up, leaving a sinus or two. Some months after, on exploring these sinuses, a similar condition is found; the purulent inflammation has again gone on spreading, and in time it may reach an adjacent joint and set up disease there. In such cases the compact tissue is usually healthy in appearance, though sometimes it is perforated, and there is generally some, but not always great, periosteal thickening. In other instances, where the changes have been rather more active, the diseased part becomes isolated and sequestra are thrown off (classic circumscribed osteomyelitis, 'central necrosis'). Sometimes the compact tissue also dies ('total necrosis'). Though this disease most commonly affects the long bones, it may, as already pointed out, attack the jaw; here even the new bone may become infiltrated, and die as fast as it is formed; it is, however,

¹ The subject of acute suppurative arthritis in infants (acute epiphyseitis) is mentioned specially under Diseases of the Joints.

whether this condition in the case of the jaw is tubercular (vide DISEASES OF THE ALIMENTARY CANAL).

CASE.—*Chronic Alveolar Abscess of Jaw*.—Joseph P., aged 6 years; admitted May 11, 1884. Fully healthy till four months ago, when he had toothache: tooth extracted, but swelling did not subside. On admission, much swelling over right side of lower jaw, from socket of first lower molar, which is gone; pus and granulation tissue evident & abscess cleared out; some small pieces of bone and a rudimentary permanent tooth removed. Discharged June 4. Re-admitted June 23, with more pain, swelling, and discharge: external incision made and pus let out. June 26, swelling &c. increased; a large sequestrum removed from inside the mouth, and several more through the external opening; these sequestra were soft, foetid, and pus-filled, and formed part of the horizontal and ascending strut throughout their entire thickness; the cavity left extended nearly up to the joint; some new bone had been formed and died subsequently. July 9, discharged much relieved.

The scapula, clavicle, ribs, pelvis and vertebrae, and facial bones are also sometimes attacked, and disease of adjacent joints may occur by extension. Though the molar and upper jaw bones are often affected, we have seldom seen any of the bones of the vault of the skull attacked, except the temporal, and this has been a result of disease of the ear. The occipital we have seen often perforated by tuberculous disease, and in the same child the frontal bone was carious. The process is essentially alike in all these cases. The sequestra are generally soft, and in some cases the pus decomposes and they become foetid, but this is not by any means generally so in the limb bones.

A similar condition is found in the epiphyses of the long bones without the shaft being involved; sometimes a whole epiphyseal nucleus will die and shell out as a sequestrum. We have met with the same condition in the patella, leading to destruction of the knee joint.*

CASE.—*Necrosis of the Patella. Disease of Knee Joint*.—John R., age 21 years; admitted July 7, 1886. Ten weeks ago had a blow on the left knee, which became painful a few days later. On July 4 it began to discharge; his health had been falling since an attack of whooping cough eighteen months ago; phthisis in family. On admission, a fluctuating swelling mapping out the left knee joint, a little redness and venous turgidity; a half-sized sinus lay over the left patella; limb nearly straight; no pain. July 18, sinus explored; it was found to lead upwards into a cavity in the patella, from which a sequestrum, the size of a hazel nut, was removed. The joint was irrigated on each side and a free communication found to exist between the joint and the sinus through the patella; enlarged lymph and vessels had escaped from the joint; operation antiseptic. August 17, limb still well, and free of sinuses was tested except at entry of drainage tube; very little discharge; general condition good; no fever since operation. August 29, discharge in a back spine; redefined as carbuncle; wounds healed; passive movements stopped, but attempts found to be strong and universal, not giving any hopes of a movable joint, so he was fixed in a back spine with plaster of Paris, and sent out November 29.

In this chronic osteomyelitis an epiphyseal line acts only as an imperfect barrier, and, where the disease begins in it, it usually spreads both upwards towards the joint and downwards into the shaft. When the whole epiphysis is involved, the articular cartilage may be exposed on the removal of the infiltrated bone, and, as its nutrition is cut off from the side of the bone, it

* Vide *Lancet*, March 1885; also *Children's Hospital Reports*, 1882. Since then we have seen two or three similar cases.

usually gives way, and in such cases the joint becomes freshened. We have, however, seen a case where complete recovery with a movable joint occurred, although the articular cartilage had thus exposed.

CASE.—*Malum osium of Tibia*.—Miss L., age 3 years, admitted November 2, 1883. History good. In June 1882, the tibiae (in August first consolidated) were a little bent, a throbbing occurred, and has been slowly increasing ever since, especially during the last fortnight; weight falling; loss of appetite, &c. On admission, some swelling of nearly the whole tibia and the soft parts over it; skin shining, but not red; temperature 98° F. Three abscesses were visible over the front and inner side close to the knee, but not enlarged. She has vomited, and diarrhoea, also, nothing unusual. She was on diet of November 10. Examined November 16, 1883. The left tibia is enlarged to nearly its normal height, and is very tender on palpation over its lower third, especially towards its epiphysal ends just above the ankle, but no fluctuation of abscess is detectable; temperature raised. January 3, under 1 year, infection made was noticed about the ankle; periosteum found much thickened; a small abscess evidently radiated into the shaft of the bone, and some time stood up; symptoms of softening gradually manifested themselves, accompanied first with a few febrile attacks, but ended, during some months, in chronic and unremitting drainage. On January 25, after removal of the tibia, a wound about healed, but big and discoloured in size, and having some greenish characters on its surface. Discharged March 25, 1884. The wound then he completely but not healed, and is still discharging; internal has opened up the sinus as far as knee joint; continues the work. April 25, the discharge is somewhat a fetid, but not offensive; but at night, however, it has become again, and is now, extremely fetid; great quantity of matter, and some blood, comes up every night, and has been kind of this; periosteum detached and a new one is being formed; it is thick, exposed, on cutting through the skin a small abscess was collected with pus and blood, and it then had a suppurative abscess about 1 cm. long and 1 cm. broad. A second abscess was afterwards made one upper third of this and it was found to contain greenish pus; the state of the matter of the other was purged and escaped out, so that a cavity could be given from the upper to the lower opening; the bone and periosteum drainage and both were exposed. After all, however, being, and large cavity is open; much drainage; temperature here, at 4 p.m., when bed with, was 100° F., which slowly fell to 98°; discharging slowly at night of few small quantities of 100° F. After the middle of April, but not much drainage; the quantity of matter was small; after being up and continuing. On November 10, temperature raised. August 11, and slight drainage from both wounds; one more or less healed. Discharged October 22. Leg more swollen than when first exposed; ulcers remain more left than. The feet are badly swelled as the pain became more.

The other forms of diffuse inflammation, which may attack the marrow of long bones have already mentioned: in the running form the medulla may be replaced by deep red or salmon-colored granulation tissue, and the bone may become so soft as to readily break down under the finger; such condition may, however, be recovered from. We have known a case where the former was so affected, and recovery took place without any great difficulty.

In abscessing or condensing osteomyelitis the medullary cavity might almost entirely fill up with irregular dense masses of bone, and sometimes isolated central sequestra exist under such circumstances.

Scattered miliary tubercles may sometimes be found in the medulla of bone as a part of a general tuberculosis; they are, however, only found post mortem, as they give rise to no symptoms during life.

* A combination of these two conditions appears to have existed in a case recorded by Mr. Peab in the *Med. Press and Circ.* 1881.

The present history of osteomyelitis is remarkably met with. In one of the most characteristic cases that we have seen, a boy eleven years old, who was in the habit of going wet and drying his clothes by fire, complained of pain in the foot: the right foot and subsequently the knee swelled, the latter suppurated and disintegrated probably a fortnight later; the left elbow, the right hip, and the left knee then were attacked. On admission, ten weeks after the onset of the illness, both legs, both knees, and the right ankle, the left elbow, and the left shoulder, were swollen: there was inflammation, and he had a spastic movement and some evidence of pneumonia: the upper jaw inflammation; he was much wasted, and his skin was dry and harsh. A month after admission the left elbow was incised: at that time there was fungus protruding over the upper part of the joint area; ten days later, on exploring the bone, there was found a bony mass not far from the middle of it. A fortnight after, the disease had extended so that the whole humerus was the seat of osteomyelitis: pus discharged freely from the medulla in the upper part of the bone. The limb was amputated at the shoulder joint, as doing so a large artery almost was exposed. The shoulder joint was healthy, the elbow disorganised: there was a sequestrum at the surgical neck of the humerus. His convalescence will bear the question, but subsequently some mischief occurred in the lungs, and he was removed by his friends, probably to die.

Treatment of Chronic Osteomyelitis.—The treatment of the different forms of chronic osteomyelitis has been almost sufficiently indicated in the description of the disease. The general management will be that of tuberculous children: locally, in the early stages, rest to the part by means of splints, and in some cases confinement to bed, is all that can be done. If the disease does not subside, the bone must be freely exposed—the limb having been made bloodless by the elastic bandage, and the bone gouged away, all tissue that is dead or infiltrated with pus being removed: if the mischief spreads far along the medulla, a groove must be cut in the bone, and all affected cancellous tissue scraped away. Should no repair take place and the disease spread to an adjacent joint, if the child's health is good, an attempt may yet be made to save the limb by incising the joint and draining it; in some cases, however, nothing seems to arrest the disease, and amputation is required.

Washing out cavities with cathartic or mercurial lotion (1 in 4,000), and free dusting with iodoform, is perhaps the best wound treatment. In some cases it is a good plan to try the application of the actual cautery to the interior of the bone, in the hope of arresting the tubercular process. In pyæmic cases incision of abscesses, removal of sequestra, and amputation are the only real resources, and each case has to be judged on its own requirements.

Strumous Dactylitis.—The condition sometimes called 'strumous dactylitis' requires brief mention here. The disease is simply chronic tuberculous osteomyelitis, or more rarely periostitis, attacking usually the first phalanx of one or more fingers: sometimes the metacarpal or metatarsal bones are affected. The disease usually begins as a hard, painless swelling of that segment of the finger, though occasionally there is a good deal of pain, and always some tenderness. If no treatment is employed, the swelling increases, the soft parts become involved, abscesses appear usually at the

1 It must be understood that here as elsewhere the words 'abscess' and 'pus' are in relation to tuberculous lesions, used in a sense implying the tubercle appearance rather than the actual pathological condition. The 'pus' is thickened, opaque tubercular material filled with serum, not mixed with simple inflammatory products, and not the Virgus of an acute disease.—*Edw. Watson Cheyne's Lectures, Brit. Med. Jour.*, 1899, for a good description of the process.

sides of the finger, and on their bursting or being opened thick crusts grow, with, perhaps, some bony deposits, escapes. On further examination, a large cavity is found occupying the site of the old shaft, which is either entirely gone or remains in part as a cheesy sequestrum, or, in some cases, if the abscess is opened early, appears to be simply bare. Around the cavity,



Fig. 109.—Hands in Tubercular Disruption.



Fig. 110.—Views corresponding to one of those which had been long the seat of Tubercular Disruption. This is a very common condition, being accompanied with the rest of the disease.

which is filled with pus and caecous matter, is a thin layer of new bone formed by the periosteum. As successive layers of new bone have been laid down and absorbed, a mottled "sequestrum" of the bone has occurred. After removal of all the cheesy matter and sequestra the finger may gradually shrink and get well, but is shortened, distorted, and usually weak.



Fig. 111.—The hands in 109 with showing the effects of Tubercular Disruption is continued.

and useless. Sometimes the destruction is so great that amputation is required. When seen in the earlier stages, constitutional treatment, with fixation of the finger on a splint and gentle pressure, will sometimes succeed in arresting the disease. It has been recommended to excise the bone subperiosteally in the early stage, and this would undoubtedly cut short the disease, but the finger is not likely to be of much use. It is better treatment to wait

passively, and keeping the finger quietly fixed on a splint to try the effects of posture and general hygiene; when vegetations are present they must, of course, be removed, and should no progress be made the cavity must be closed out—but, as a rule, a more useful finger is obtained by expectant than by active treatment.

Should, however, abscess form, the best plan is to freely open and carefully scrape out the abscess cavity, removing all caseous material. The cavity should then be well doused with iodiform and boric acid or some antiseptic creosote injected, and the wound should be closed by sutures where drainage. Primary union will usually be obtained if the wound is kept aseptic.

When many fingers are affected, and the disease is most commonly a part of 'General Surgical Tuberculosis,' it is most frequently met with in the first few years of life. The disease is probably sometimes periodical rather than continual.

'**Syphilitic Dactylitis**,' so called, is more often described than met with. The general appearance closely resembles that of 'gummatous dactylitis,' and it is said that in children the disease is usually primarily an osteomyelitis, though the gummatous material may be deposited first either in the periosteum or soft tissues overlying it. The occurrence of dactylitis in a child showing other signs of congenital syphilis would lead to a suspicion that the affection of the fingers was also specific. The results are usually very much the same as those of the tuberculous lesion, and the treatment is simply that of syphilis.*

'**Leontiasis Ossea**' is a disease in which the bones of the face, especially the upper and lower jaws and the nasal bones, undergo hyper trophy. The disease begins in early life and may go on indefinitely. In a case we saw which had been under the care of Dr. Brown, of Baccup, and Mr. T. Jones, the disease began at 9 years old, and the patient when we saw him was 26.

(* Vide *Booker on Lues venerea*, 2nd ed., 1881, 1885; or an abstract in *Med. Chron.* February 1886.)

CHAPTER XXVIII

DISEASES OF THE JOINTS

Diseases of the Joints.—There is no essential difference between the joint diseases of children and those of adults, but certain forms of disease are found most typically, or even almost entirely, in childhood. The conditions of growth as regards the relations of epiphyses to the adjacent parts and to the shaft of the bone are, however, most important factors in determining the occurrence of disease and the kind of lesion met with, and, further, the liability of children to the various exanthemata is of such importance in regard to joint affections. Ordinary acute synovitis from injury or cold is in no way peculiar to, nor even specially common in, children, and need not be discussed here; while hip disease, acute suppurative arthritis of infants, scarlatinal synovitis, and even the common tubercular puffy disease, are instances of the modifying effects of the conditions of childhood upon forms of lesion which are also to be met with in adults.

In early life the lesions of joints are more complex than in adults, for the reasons already alluded to, that not only may disease begin in the joint structures proper, but it may often reach the articulation by extension from the neighbouring epiphysis or epiphyseal line. It is generally said that bone lesions are limited by the epiphyseal zone and do not extend to the bone below; this, as already shown, is only partially true, and, besides this, disease spreads frequently from a starting point on the epiphyseal line, or from the periosteum of the diaphysis, and extends to the capsule, and so to the synovial membrane. There is, however, often effusion into a joint adjacent to bone disease without actual continuity of disease. [For further details see chapter on BONE DISEASES.]

Joint disease, then, in children may arise as a simple acute serous effusion, which may subside, suppurate, or become chronic. Chronic simple serous synovitis is, however, rare in children. There may be a primary acute or chronic tubercular synovitis. Pyæmia or certain of the exanthemata, notably scarlatina and typhoid, may give rise to an acute, sometimes suppurative, synovitis, while measles and whooping cough, as well as scarlet fever and typhoid, may result in a development of tubercular joint. Finally, the joint disease may arise by extension from the shaft, epiphyseal line, or from the epiphysis itself, and possibly from the ligaments and tendon sheaths in exceptional cases. The specific fevers are not so often, as is sometimes stated, the direct cause of joint disease; it is in most cases

rather than the depressing effect of the fever makes the child more liable to the onset of disease—thus of 125 cases of joint disease, taken consecutively from our records, including cases of disease of the hip, knee, shoulder, elbow, ankle and tarsus, and wrist joints, in only six cases was the joint affected a sequela of measles, in four of scarlet fever, in two of typhoid, and in three of whooping cough. Only those cases were reckoned in which there was no interval of health between the exanthem and the joint trouble.

In certain joints bone lesions are far more commonly primary, as in the hip, and perhaps the shoulder; in other joints, as in the knee, ankle, and wrist, bone disease when present is much more often secondary to a primary synovial inflammation, while in other joints again, as in the elbow, either sort of joint is common.

The hip is by far the most frequently diseased joint in children, and the knee comes next. Of 695 cases of joint disease under our care in the out-patient department of the Children's Hospital in three years, 369 were cases of hip disease, 160 of knee disease, and all the other joints together amounted to 166. Disease of the spine is excluded from this calculation.

For any detailed account of the pathology and symptoms of each diseased joint we must refer to the special works of Barwell, Marmstrong, Howard Marsh, Hartter, and others; space will only allow of selection of the hip and knee as types of the two forms of joint disease found in childhood, with a brief reference to the other most commonly affected articulations. Hip disease stands so much by itself that its consideration will be most conveniently postponed till after that of the other joints.

Chronic disease of the knee joint may be taken as the type of joint disease beginning in synovial membrane—*palpy disease*, chronic synovitis, tubercular synovitis, white swelling, and various other titles, all implying the same condition.

Here we may say at once that we believe all the cases of chronic disease of joints marked by great thickening of synovial membrane, with little or no tendency to accumulation of fluid, but with great tendency to the formation of small multiple abscesses in the thickness of the gelatinous tissue, are truly tubercular in the most strict sense. In some cases a considerable amount of fluid, either serous with caseous material and flakes of lymph, or more puriform, is found in the joint; this is, however, not a common condition in children. In many instances evidence of tubercle elsewhere and a tubercular family history will be found; in many, death ultimately results from tuberculosis of other organs. The anatomical characters of tubercle are constantly to be found in the palpy tissue, and, though not so constantly or readily, yet in a large number of instances tubercle itself has been detected.

The usual history of a case of chronic tubercular synovitis of the knee joint in a child is as follows. There is perhaps a history of phthisis or joint disease in the family; the child has been healthy, till at the age of, say, four years it was attacked by measles or some other exanthem. It was slow in

¹ In 132 histories of chronic joint disease under our care (the spine being excluded) 41 (30.3 per cent.) showed some trace of tubercular family history; in 61 (45.8 per cent.) cases the disease had followed an injury. In 22 cases out of 132 phthisis alone was more than one trace, i.e. there was evidence of tubercle elsewhere.

recovery, and was never quite strong afterwards; a year later, perhaps, it received some injury to the knee. Shortly after the knee swelled, but gave rise to no great pain or inconvenience, except a slight limping and feeling of tiredness; the swelling slowly increased and became somewhat more painful, especially at night, with slight stappings. We cannot too strongly insist upon the fact that tubercular disease of joints may go on for months, steadily getting worse, without any pain at all, and with but little impairment of mobility; this so frequently occurs, and yet is so frequently a cause of mistakes, that we desire to emphasize the statement here. When the child we will suppose comes under observation. The knee is found markedly larger in circumference than its fellow, its natural hollows are obliterated, it may or may not be slightly hotter than the other, there is slight flexion, and usually it cannot be fully extended, any attempt to do so causing pain. There is considerable pain on pressure over the inner tuberosity of the tibia, and to a less degree over the other side. The swelling is soft, elastic, and pseudo-fluctuating: it more exactly follows the normal outlines of the joint, or is more globular, the upper synovial pouch not being thickened; occasionally the swelling is almost limited to the upper sac. There is pretty free mobility of the joint at this stage, unless an attack of acute inflammation has supervened upon the chronic mischief. Such a case left to itself will however become more flexed and less mobile, abscesses will form and burst at the sides or front of the joint, the swelling will increase, and the veins over the surface may become dilated and full; the tibia will become ulcerated backwards and outwards, and at the same time rounded outwards upon the femur; the limb will become wasted and powerless. In many cases pain increases and the child's health suffers, until at last the pain and discharge, or the invasion of other organs by tubercle, wears him out.

The severity of the symptoms varies greatly: in some instances pain and stiffness exist throughout; in others free, though not usually full, mobility and absence of pain may be found during nearly the whole course of the disease.

If a knee joint, such as the one described, is laid open, the synovial membrane is found everywhere converted into a thick, pulpy grey or yellowish, semi-transparent material, soft and gelatinous to the touch, but is partly rough and elastic: in parts the grey tissue is streaked with opaque brown bands, and here and there caseous foci will be found softening and breaking down—these are especially common towards the posterior part of each femoral condyle. These breaking-down foci do not usually communicate with the cavity of the joint itself, which is largely filled up by the thick granulation masses, and contains little or no fluid.

The pulpy tissue grows over the cartilages at first in delicate vascular fibrin or films, but afterwards these become thicker and form false joints replacing the cartilage at the edge and lying in gaps dug out of its surface, so that finally only a small central island of healthy cartilage remains in the middle of each condyle and each articular surface of the tibia.

Often granulation sprouts spread beneath the cartilage and, drawing it from the bone, give rise to superficial necrotic ossitis, 'subchondral caries,' which causes necrosis and separation of the articular cartilages.

The surviving cartilages are as it were embedded in the gelatinous tissue,

and in some far advanced cases can hardly be distinguished; usually, however, they are readily made out. The crucial ligaments are coated over with the pulpy tissue, and are often very vascular, with bright streaks of vessels running along them: on scraping away this tissue the ligaments are found to have nearly their natural appearance, except that here and there a little spot has forced its way between their fascioli. The degree of destruction, however, of course varies in different cases, and in some the tubercular focus is at first, strictly limited to one patch of synovial membrane.

The cavity of the joint is often undivided into loculi by adhesions between masses of the granulation tissue. The gouging out one of the granulation pits in the cartilage, it will be found in some cases not to extend through, in others the bone beneath is reached and locally eroded.

The capsule and lateral ligaments &c. are much thickened, and this gives rise to the deceptive sensation of bony thickening so often met with in the knee. However much it may appear that there is enlargement of the bones in a case of chronic disease of the knee, it is almost perfectly safe to say that the thickening is in the soft parts alone, and that there is no new bone formation. It is only very rarely that a layer of periosteal new bone is found beyond the limits of the capsule. The presence of new bone about a chronic tubercular joint is usually a sign of repair and of infirmity of the disease; sometimes, however, it is associated with chronic bone disease (chronic osteomyelitis), never, we think, with progressive synovial disease. Mr. Watson Cheyne, however, states that microscopically thickening of bone trabeculae precedes tubercular infiltration in cases of the articular ends of bones.

There is usually more or less atrophy of the bone adjacent to a chronically diseased joint. The cancellous tissue is more open in texture, and the compact tissue thinner than in health. Wasting of the bones, in fact, takes place, just as of the muscles and other tissues around the joint. These changes are general. When local patches of marked rarefaction are present, that part must be considered the seat of actual disease.

In the great majority, however, of cases of disease of the knee the bone is healthy, unless the disease is far advanced; when this is so, spots of soft ramifying bone and cancer patches will be found, the latter in their early stages being recognised by the yellow and red mottling in the neighbourhood of the articular cartilage, with some rarefaction. It is often very difficult to be certain of the condition of bone in very early stages of disease: patches of various shades of yellow and red are met with in perfectly healthy bone; where there is any local rarefaction or *opaque* yellow deposit disease is present. In some instances, however, sequestra of varying size are found—most commonly in the femur, less often in the tibia; usually the necrosis is on the back of one or other condyle; we have, however, found it in the middle of the intercondylar notch. Where necrosis does occur the disease often runs a considerable way through the bone, or rather the disease has probably begun in the epiphyseal line or epiphysis itself, and extended towards the joint.

As Mr. Howard Marsh has pointed out, a condition of 'quiet strenuous disease' may exist, leading to a stiff joint without any active stage or suppuration; we have seen such joints occasionally, and they are to be distinguished

by having a greater amount of solid thickening than occurs in many synovitis, but less than in the ordinary tubercular joint.

Tubercular Disease of the Shoulder is rare in children; there is hardly sufficient evidence to show how often the disease begins in the synovial membrane and how often in bone. The swelling forms a globular mass most prominent in front, and stiffness of the joint is usually evoked. When suppuration occurs the abscesses usually point behind or in front of the deltoid, or occasionally in the posterior triangle; no information as to the primary lesion can be obtained from the position of the sinuses, since extra-articular abscesses due to epiphyseal discharge in the same spots. Disease in the epiphyseal line may or may not lead to destruction of the joint. In an interesting case we removed, as a sequester, part of the upper end of the diaphysis, including the epiphyseal line, and subsequently nearly the whole shaft of the humerus; the inflammation had spread from the periosteum to the capsule, and the ligaments became so relaxed that there was a deep groove below the acromion, the humerus having dropped away from the scapula; the joint did not suppurate, and all went on well.

We have only two or three times found it necessary to excise the shoulder joint in children; in all the other cases the disease has subsided, or the case has been lost sight of. In one instance, where there was much necrosis, a very useful limb resulted with $\frac{1}{2}$ inch shortening, and but little wasting, and the joint was hardly at all visible.

CASE.—Disease of Shoulder Joint. **History.**—James H., age 2 years, admitted July 20, 1872. Three years ago the left arm was seen to be stiff and painful; distress followed about the shoulder and were speedily, as he has remarked, "for last eighteen months had been discharging" with constantly, and lately the child had lost flesh—"an epidemic family; other children healthy. On admission, rather pale, but fairly rounded face; general thickening all round the left shoulder; a patch of red thrombosed integument, with two laminae, in view of the insertion of the deltoid, and a sinus in the posterior border of the muscle; the pectoral fold bulged downwards and forwards; from this part a movement, July 20, much discharge, especially on pressure about the axilla; very little mobility, even under anæsthesia, slight power of rotation alone remaining. August 2, the upper end of the humerus was exposed, together with about an inch of the shaft, by a single straight incision at the anterior border of the deltoid; two blood sinuses were found in an abscess cavity surrounding the head of the humerus; the joint was exposed (discovered); the glenoid cavity and acromion were roughened; there was some deposit of new bone around the upper part of the shaft of the humerus; the part removed was very extensively necrosed, but there was a large cavity in it; tracheal drainage, band along with it; some use of compresses followed. He went on well, but slowly; in December some more white tissue was seen, but this subsided subsequently, except a small prominence on August 26, and two more small pieces which came away in September. Further movement was begun on September 27, and on the 28th some free movement was made under chloroform. He had shakiness now in walking, and was discharged with countess still open on November 3. Passive movement failed subsequently to give him any great amount of mobility. February 25th, he is well and strong, and has good use of the arm, but the movement is almost entirely at the acromion; the limb is not much wasted, and there is $\frac{1}{2}$ inch shortening.

Disease of the Elbow Joint arises either as a primary synovitis or about equally often as disease of bone; in the latter case the disease in one of the condyles, most often the outer, is first attacked. Well-marked bony sinuses are often found in one or other condyle, but any extensive disease of

so rare is very rare. Swelling extends all round the joint, but usually appears first over the radio-lunar line of the back of the joint. Later the line of the joint becomes swollen: this is sometimes due to glandular enlargement, comparable to the swelling of the inguinal and iliac glands in hip disease; in other cases the supra-condylar gland apparatus. When the disease is the seat of the primary lesion the sinus is usually over it and leads directly, or nearly so, down upon it.

In old neglected cases, the number of sinuses is sometimes considerable, and the soft parts are indurated and much destroyed by gummy infiltration. The joint is kept slightly flexed, and there is usually much muscular wasting. Occasionally we think the disease begins in the elbow-bursa, which is so common a starting-point for mischief in older patients; this bursa is sometimes chronically enlarged in children. Stiffness is an early and marked feature of disease of this complex joint, though the mobility of the fingers is good, even if there is much infiltration of the muscular attachments about the elbow.

CASE.—Joseph L. D., age 2 years 11 months; admitted January 27, 1886. Left elbow injured by a fall in April 1884; had been swollen ever since. The movements, widely-looking child; the left elbow was flexed and the hand was pressed; very little mobility; two sinuses at the upper and back part of the joint felt close to rough bone; a little tenderness, but no pain; general swelling all round the joint. February 2, the bone exposed; disease primarily articular; cartilage thinned; especially on head of radius; hyaline cartilage; the back was red, raw, or angular splint. On the 15th passive motion was begun. On March 1 passive movement could be carried through the full range in all directions, and there was a little point of active movement; the wound was nearly healed; discharged; healthy, thin, at outpatient; elbow quite healed; had almost perfect range of mobility in every way, and the arm was strong; he could sit at his work.



FIG. 104.—Tubercular Disease of the Wrist.

The Wrist Joint is perhaps even more rarely affected with tuberculosis than the shoulder, but in children we find on three or four occasions had to expose the joint; in all, the wrist joint itself, as well as the whole carpus, was diseased, the disease having spread along the synovial sacs. In our instances the mischief began in the line of the second metacarpal bone, in the others the starting-point was apparently synovial. In two of the cases an excellent result followed, the whole of the carpus, the bases of the metacarpal bones, and the lower ends of the radius and ulna having been freed by a single median dorsal incision between the tendons of the *extensor indicis* and the *extensor secundus intermedius pollicis*; no tendon was cut through, though necessarily those attached to the parts removed were stripped back. In both of these cases a nearly perfectly mobile joint

was obtained with almost full mobility at the metacarpophalangeal articulation—the point of greatest difficulty in disease of the wrist.

*CASE.—*History of Henry Tread.—About 80, age 3 years. Admitted March 29, 1889. History unimportant. No cause known for swelling of left wrist, which began six months before admission; much pain, produced by three wounds. On admission, it assumed locking quality; no gaital signs of left wrist at lower end of arm and at elbow; wrist thinning round wrist; fluctuation at level of capsule; movements, including pronation, those of normal young person. April 16, incision over capsule posteriorly here removed by longitudinal incision under skin; some loose bodies found and removed; others, very large, and removed through posterior incision. May 1, wound fully exposed fully and is now healing. Synovial tissue—fine and smooth; not so light; tendons very good; cysts and nodules (fig. 324).

One patient remains well; the other, after keeping well for a long time, developed tubercular tenosynovitis, which will probably cause cessation of movement. In the third case the capsule alone was taken away, with an even better result. The operation mentioned is practically Langenbeck's; it is much simpler than latter's method, and we think much superior to it; the bones which are not already softened and destroyed shell out easily from the pulpy material in which they are embedded. The position of the sinuses in carpal disease is important, but the general appearance is shown in fig. 324.

Chronic Tubercular Disease of the Ankle is much less frequent than that of the knee; but in four years we had 25 cases of disease of the ankle or tarsus admitted as in-patients at the Children's Hospital. Of these, excluding disease of the os calcis, most of the cases were probably primarily synovial, but in the tarsus extension of disease around the small bones or interference with their nutrition, and so readily spreads to their nearest, that in late cases there is always more or less destruction of bone. We can only recollect one, or perhaps two instances of primary necrosis of the scaphoid setting up disease of the ankle joint; but it is much more common to find mischief spreading from the lower epiphysis of the tibia to the joint.

Except the posterior calcaneo-astragaloid joint, the anterior calcaneo-astragaloid and its continuance, the astragaloscaphoid joints are, perhaps, the most constantly affected of the tarsal articulations; but the common talo or any of the tarsal joints may be attacked by disease, which then spreads from one joint to another. Calcaneo-astragaloid disease is very frequently the result of necrosis of the os calcis, and it not rarely extends spread to the ankle joint itself.

Disease of the ankle joint is marked by swelling at the back of the joint, distorting the hollow on each side of the tendo Achillis, and then spreading round and below each malleolus, especially the inner (fig. 325); the front of the joint also becomes swollen, and acquires a peculiar flatness or squareness of outline as a result of loss of substance of the extensor tendons. The foot is usually kept with the toes pointed, at other times it is flexed; the leg rigidly wastes; later, sinuses appear, usually above or behind the malleoli. It must be remembered that disease often extends from the joint into the sheaths of the neighbouring tendons, and in such cases suppuration or swelling may track up the leg or along the foot for a considerable distance; the general conditions do not differ from those met with in the

toe. In disease of the tarsal joints the foot is swollen in the portion corresponding to the affected articulation, and movement of the particular joints may be painful. This is not, however, a very trustworthy symptom in tubercular disease, though of much value in acute inflammation. When the common sac is involved the foot assumes a puffed-out look, with the toes pointed and pressed closely against one another. The disease often spreads beneath the skin or along the plantar tendons, and gives rise to widespread oedema in the soft parts, so that it simulates a virus always indicates disease of the tarsal joint. The arch of the foot is seldom lost, in consequence of the resistance of the rigid structures in the sole of the foot. With two exceptions, the disease is usually primarily synovial: one is that already mentioned, of cancer or necrosis of the os calcis, which often extends to the calcaneo-scapulaoid joints; and the other, that it is common for disease of the first metatarsal bone to extend backwards to the joint between it and the internal cuneiform.

It is sometimes difficult to be sure whether an abscess on the dorsum of the foot—the more common situation for pointing in tarsal disease—is connected with the joints or is merely peri-articular: in some cases pain on pressure or movement of individual joints, localised by pressing back towards the ankle individual toes in turn, in others swelling over some particular joint or in the sole, will indicate a deep lesion; but often exploration is required before a certain conclusion can be arrived at.



FIG. 110. Tubercular Disease of the Tarsal Joints.

Acute simple Serous or Suppurative Synovitis is uncommon in childhood except as the result of injury or inflammation; any joint may be affected, and the symptoms in no way differ from those seen in adults. There is swelling, which, being due to distension of the synovial sac, follows its outlines; heat and pain, with immobility and some constitutional disturbance, are also present. The inflammation commonly subsides readily by treatment with splints and ice or evaporating lotions, and leaves no ill results. In some cases, however, usually in unhealthy children or where there has been a wound of the joint, suppuration occurs; all the symptoms are then greatly aggravated, any movement is exceedingly painful, and the temperature may rise to 103° – 104° .

The acuteness and severity of the symptoms vary much in these cases: in one instance the hip joint suppurated, nearly the whole thigh was occupied by a large abscess, the head of the femur was partially destroyed, and the mischief extended to the knee joint, which also suppurated; both joints were involved, but the child sank and died. Pus was found in the knee, with superficial erosion of cartilages; the synovial membrane was thick and

hyperæmia; the thigh was infiltrated with sero-purulent fluid, and the acetabulum was granulation-lined.

In other cases there is a thick 'mucous' discharge and the cartilages are not destroyed: in these cases incision generally results in recovery with a mobile joint. This form of disease most commonly occurs in children under two years of age, and is met with in the knee—less often in the shoulder, elbow, hip, or foot. Somewhat like the above mentioned catarrhal inflammation of joints, described by Volkmann, appears on us a form of purulent exudation, not connected with pyæmia or erysipelas, which has been described by Aikin, of Sheffield.*

Pyæmic Joint Disease is not rare in children, and may run its course in chronic form. The articular lesions may be the only evidence of pyæmia, or they may occur in conjunction with bone or visceral abscesses. Both forms of disease are exceedingly dangerous, though neither by any means always fatal. We have had a case under our care of a boy aged 35 years, who had pyæmia after measles, and subsequently suppuration in one shoulder and one knee, with effusion into one of his ankles, and double erysipelas, together with abscesses in other parts; this child recovered perfectly, with a mobile knee, though with a somewhat stiff shoulder. Effusion into a joint in pyæmia is not always purulent, nor does the presence of pus in a joint or elsewhere always demand incision and drainage: the effusion may be absorbed, or, after aspiration, may not recur, and on examination the articular cartilage may be found quite smooth and healthy, or only somewhat yellow and opaque. In other cases, however, the cartilage becomes necrotic, or it may rapidly melt away entirely or in patches, leaving the articular lamina of bone smooth and bare: this is perhaps the most typical condition of acute pyæmia.

Exanthematous Synovitis, or that form of joint disease which occurs in connection with the specific fevers, has already been alluded to in discussing those affections, and scarlatinal synovitis or rheumatism has been fully described (p. 264). A second variety occurs generally, but not always, late in the course of the fever, and usually in connection with severe throat lesions. The affected joint suppurates and becomes disorganised: this is clearly a pyæmic condition.[†] It must also be remembered that the exanthema is sometimes a determining cause of the appearance of a tubercular lesion. Typhoid synovitis is rare, and is said to be almost limited to the hip joint: we have, however, seen the knee attacked, and, as Gilchrist has pointed out, the spine may be affected. Synovitis, probably pyæmic, occurs as a rare complication of diphtheria. An exanthema such as measles fever or scarlet, occurring in the course of a joint disease, usually gives rise to suppuration and rapid destruction of the joint: in some cases, however, it appears that, as in the case of erysipelas, the more active inflammation does good by causing melting away or absorption of the chronic inflammatory material.

Chronic Rheumatic Arthritis occurs occasionally in children, both in its

* *Brit. Med. Assoc.* July 12, 1885.

† Cases of increased liver have been found in the pus from such joints by Hissler and Schacht, and a similar joint affection has been caused by inoculation with autolysates from tremular nodules by Löffler. *Die Dtsch. Woch.* November 1, 1892, of *Abhandl.* by Dr. Ashby in *Med. Chron.* December 1894.

polyarticular (nodular) and monarticular forms, as pointed out by Charcot and others, and we have once or twice seen it. It must be remembered that such cases may become tuberculous, and we have seen a joint which had the characters of chronic rheumatic arthritis well masked, which subsequently became an ordinary pulpy knee, just as occurs in adults; the two conditions may be seen co-existing in one joint.

Case.—*Chronic Syphilitic Tetradia*.—Mary Jane E., age 13 years; admitted February 25, 1884. No rheumatic or gonitic history. Duration since August 1882, when she had pain in her shoulders, which subsided in a week. Nine months ago had pain in left hip, which lasted four months; then the left knee was attacked. Both were swollen; no other joint affected; pains worse in wet weather; not increased in heat; sweats a good deal at night; urine often contains red blood. On admission, well nourished, slight rashes of face; throat swollen, normal; right knee a little swollen; no swelling or thickening; no osteophytes. Left knee, thickened synovial fringes; well-mineralized; edges of both condyles directly opposed. Her condition improved with salicylate and iodide of potassium, and she was sent out on March 15.

Syphilitic Synostosis is occasionally met with; we have, however, only met a few cases of pure *ostitis* in the first few months of life in congeni-



Fig. 121.—Congenital Syphilitic Synostosis of both Hips.

tally syphilitic children; the most common condition is syphilitic tetradia. A salubrious recurrent syphilitic synostosis occurring in older children is met

with; it sometimes rapidly subsides under antisyphilitic treatment, as in the following instance:—but this is not always the case—it is sometimes either intractable,

CASE.—*Syphilitic Synechia of Chin.*—J. B. (now 3 months) admitted Oct. 26, 1874. A history of syphilis in the mother was given. Of course there have been syphilis, even being dead; patient herself had always been healthy. Two days after the left knee swelled without known cause, but increased completely in fourteen days; the eye had been bad since May 1874; the right eye was then affected, and the ear was only attacked three weeks ago. Now ear had much phlegm; the left knee began to swell on October 29; the child a good deal of pain in it. On admission, the left knee was much discoloured with blood, and was slightly hotter than the right; the foot normalised, normal tension, which was, however, subsiding; lower aspect of teeth also normalised; no other signs marked. Under hyd. c. cret. and pos. iod., together with a leech going to the knee, all the swelling rapidly subsided, the eyes improved, and the ear discharged nearly well, on November 22.

Cutler has noticed the occurrence of symmetrical synechia of the knee in congenital syphilis, and Gatterbock¹ other cases of symmetrical effusion; we have seen the same thing associated with poisons of both kinds. Cameron and Lane record a case of suppurative synechia of the hip, knee, shoulder, and both elbows in a child with congenital syphilis; there are nodules also present, but no epiphyseitis.²

The best treatment of these cases is the administration of iodide of potassium internally with hydrag. c. cret., while mercury ointment should be rubbed into the part affected; if there is much pain, blisters will sometimes give relief. **Osteorheumatism** is sometimes met with in children in association with vaginitis or ophthalmia neonatorum, as pointed out by Clement Lucas and others. We have seen an infant a few weeks old in which a stiff dorsal wrist remained as the result of what was described as "erysipelas of the hand." The swelling of the hand was noticed on the evening of the day the child was born, and it had also prevalent ophthalmia.

Acute suppurative Arthritis of Infants, first described by T. Smith of St. Bartholomew's,³ is a remarkably well-defined affection of fairly frequent occurrence. It is limited usually to children under a year old, though we have occasionally seen it in older children, the eldest being nearly two years of age. Pathologically the disease is an acute epiphyseitis leading to rapid destruction of the ossifying centre of the bone it attacks, with perforation into and disorganisation of the adjacent joint. In one instance the epiphyseal nucleus of the head of the femur was found lying loose in an abscess cavity, or rather in a sinus leading from the joint. A large number of the infants so attacked die of pyæmia. The hip is the joint most frequently affected, the knee standing next. Of our cases of our own the hip was involved in eight instances—six times alone; in one other case the knee was involved by direct extension, and in another the wrist, shoulder, and hip were implicated. In two instances the disease followed whooping cough, in one it came on after an injury, and in one there was evidence of the onset of the disease in utero was obtained. We have adopted Mr. Smith's view that the lesion is primarily

¹ *Rep. Med. Soc. Med. & F. Society.*

² *Brit. Med. Jour.* January 1876. Clark Soc., Trans. 1874.

³ *Morison Inks*, John Poland, and one of the present writers were also consulted in the literature of the subject.

epiphyseal; and it is so certainly in the majority of cases, but in one or two we have not found evidence of anything more than synovial disease; these would perhaps rather correspond to Vosselman's 'catarrhal synovitis'; and, on the other hand, we have met with several cases in which the abscess pointed inside the joint, the cavity of which was not involved. In one instance the lesions were secondary to a cervical abscess, and there was epiphysitis of one shoulder and a peri-articular abscess of the other, so that sometimes at least the presence of an abscess about a joint in an infant is not due to an epiphysitis, and sometimes it is not an arthritis. Böttle believes it to be usually an affection of the end of the diaphysis¹ primarily. It is often difficult to make up the connection between the abscess and the joint, but with care it may be found in most cases. The severity of the disease varies considerably; in some instances the involved part goes on for two or three months, in others it is fatal in a few days. The characteristic features are the age of the child; the incidence of great swelling round the affected joint, often involving nearly the whole limb, and not uncommonly 'flying about'—i.e. one limb becomes swollen and then subsides, then the swelling appears in one of the other limbs, and finally the disease becomes localised in one joint only, leaving the parts first attacked unimpaired. This curious feature of the disease perhaps indicates its relation to pyæmia. In acute cases there is much fever, but there may be little rise of temperature in the more chronic ones. We have one case in which tubercle was apparently engrafted on a case of 'acute suppurative arthritis' of the hip.

The symptoms and course of the disease point to thrombosis, extending from the vascular cancellous tissue, or to embolism, but we have not verified this condition *post mortem*. The size of the abscesses is sometimes remarkable; in one case the whole thigh, from the hip to the knee, was a bag of pus, both joints being involved.

These children are generally much prostrated and often very anæmic, worn out by pain and rapid outpouring of pus.

Treatment consists in early and free incision into the abscess, opening the joint if it is swollen, and keeping it well drained. Stimulants and abundant nourishment must be given. It is not necessary to put the limb in a splint in infants, but it is a good plan to tie it up in a pillow so as to keep it steady; there is little or no fear of a stiff joint. Probably half the acute cases die. If recovery takes place, the limb is usually shorter and weaker than the other, but there may be a practically perfect recovery, and there is generally good mobility. We have several times seen older children with weak limbs clearly the result of this disease in infancy. Arrest of growth is less likely to occur where the hip is involved than the knee. The two following are fairly typical cases.

CASE.—*Acute Suppurative Arthritis of Hip*.—John W., 1 year 3 months; admitted May 3, 1894. History good; seems very strong; no known cause; swelling about hip six months ago. On admission, pale, but not thin, anæmic round right hip; grating felt by joint. Swollen, head of bone gone. All taken fluid with much discharge; temperature subnormal. Died moderately, but in 48 h. and looked pale and ill. Feet bound on right with wound superficial. Subsequently some suppuration occurred, but after a third struggle the fluid became round and well, with good mobility and little discomfort.

CASE.—*Acute Suppurative Arthritis* of Knee.—Mary H., age 2 months; admitted March 28, 1884. Fairly healthy child; child first noticed in her hands and feeters some days ago; the knee then swollen usually, and was very tender; the swelling is now less than it was a few days ago. On admission, a well-nourished child; right knee swollen, hot, tense, and shining; the tibia felt weakly; girth 20 in., at navel and 24 in. at the left side; temperature 99°. Two hours' incision on outer side, and a quantity of pus escaped. 24th, swelling gone down; a fair amount of discharge; takes food well, and sleeps well; temperature 99°. April 1, pus flowing upwards and inwards; a large tumour, 1 1/2 in. swelling less; doing well. May 2, all swelling gone; tube removed, and wound healed; all well.

Acute Tubercular Synovitis is not a very common affection; it does, however, occur, and rapidly goes on to suppuration in quite young children. The most typical instance we have seen was in a baby ten months old, in whom suppuration of the ankle occurred a week or two after a wound over the joint. On incision a few drams of curdy pus escaped. A week later the child died of pneumonia and was found to have generalised tuberculosis; the lungs, liver, kidneys, spleen, and brain were all affected. Here, from the condition of the tubercular masses in the bones, it was clear that tuberculosis existed at the time of the injury to the skin over the ankle, and the joint subsequently became tuberculous. The case serves to illustrate the fact that in the first year or two of life suppuration occurs as a result of inflammation more readily than in older children. Acute tubercular disease also sometimes follows strains or fractures in the neighbourhood of joints; thus we have seen advanced purpy disease of the elbow, in a girl of eight years, six days after an injury which loosened the epiphysis of the inner condyle and trochlea of the humerus. The following case is also noteworthy as an illustration of the occasionally acute onset of the disease.

CASE.—*Acute Purpy Arthritis*.—Harry A., age 3 years 6 months; admitted January 2, 1884. No tubercular history; had measles at two years of age, followed by whooping cough; disease of knee first noticed fifteen days ago; no cause known. On admission, joint well-swollen but not hot; right knee is much enlarged, joint hollow obliterated; swelling starts; no marked fluctuation; movements very limited and painful; right knee rigid, left knee pliable; extension applied. 25th, knee straight; no night pain; general condition good. 26th, as same fluid was thought to be present, the knee was aspirated, and ten drams of sero-purulent eff. 27th, temperature normal; general health good, but there is still fluid in the joint. February 4, the knee was enlarged to its original size, a Fowler's splint was applied, and he was sent home. Discharged April 25. He wore the splint up to consolidation, and has been doing fairly well till now. On admission the swelling had increased to 12 in. and extends some distance up the thigh; the veins are full, and the skin tense and shining; the patella loose; five incisions were made into the joint; a large quantity of turbid serum escaped from the incision on the outer side, while from the inner side, which was somewhat lower down, pus flowed; operation aseptic; drainage as usual; the wound was dressed on May 2 and 12, when there was not much discharge and the knee was quiet; incisions were closed on 7th, with still a good deal of swelling; some thick, creamy pus escaped out; the knee did not improve much, and on June 20 he was taken home by his friends. July 8, red-swollen knee; 20 in. circumference, 18th, temperature 101°; some exudate of pus on inner side of thigh above knee. 24th, extension of joint; much thick purpy material, cartilage swollen, but surface of tibia healthy, except a small portion on the inner margin, which was gouged away; surface of lower bone red and rough and loose; tibia and fibula several points of pus; when gouged the bone was quite soft, yellow and infiltrated with pus; this was removed, leaving a cavity 1 in. long and 1/2 in. deep in the tibia condyle; the bone surface and the upper epiphysis only were exposed with the thermometer, dressed with iodoform, and the limb was put up

as a Hare's splint: wood-wool dressing: on arrival of the girl at the firm removed a yellow crusted mass, was found surrounded by soft tissue; there was much shock for some time, which was treated by quinine, nuxvom. and alcohol: did fairly well, and temperature was down about 100° till 24th, when the knee was dressed for the first time, the suppuration having run up suddenly to 104° (7): wound looked well and was quite sweet: pads of wool-wool suitably soaked: temperature fell and was not above 100° after 9th. August 3, first discharge, doing well, but spirit failed: it was removed and replaced one day; next several frs. 10th, tubes removed: there was afterwards some trouble with the splint, which needed changing, and the wound on the 14th was no longer aseptic; the rim became displaced somewhat backwards and some fresh suppuration followed: this was assisted by making him lie on his face for half the day: he slowly improved, and on October 15 the wounds were nearly healed, and he was sent to Convalescent Hospital, April 18th, one year, the rest of the wound well shrunk: not yet firm, but in good position; fat and well.

The treatment of the various joint affections can only be briefly given here: it is impossible to mention all the applications and apparatus that have been devised. In acute non-suppurative joint affections of the upper limb, in the case of the shoulder, it is sufficient to strap the arm to the side, or, if the child is very young, to bind the limb with a flannel bandage across the chest; lead lotion in infancy and an ice bag in older children is the only further application required. For the elbow nothing is better than a common inside or outside angular splint, which must reach from the axilla to beyond the end of the fingers; all short splints, leaving the wrist and fingers free, are obviously inefficient. For the wrist a straight palmar or dorsal splint reaching from the elbow to beyond the finger tips should be applied.

For the hip a Bryant's or Thomas's splint should be put on, or, in their absence, a long Linton's splint does very well. For the knee and ankle the ordinary back splint with a foot-piece should be used, taking care that when the knee is the part injured the splint reaches well up to the buttock. A Thomas's knee splint answers excellently for all stages of knee-joint disease, but the child must of course be kept in bed for acute affections of the joints of the lower limb.

When suppuration occurs free incisions should be made into the joint, and drainage tubes inserted; where there is no previous opening, and the wounds are aseptic, washing out of the joint may be employed, and the wound then closed by sutures or the cavity may be drained, choosing a dependent position for the incisions, and avoiding the dangerous anatomical area of each joint. In sub-acute cases, with sero-purulent fluid or even pus in the joint, aspiration should be tried once or twice before free incisions are made: but the joint must not be allowed to become diseased with fluid, since this frequently leads to subsequent ligamentous weakness.

In chronic non-purulent effusion, and in cases where a simple synovitis has left thickening behind, elastic pressure by a Martin's bandage lightly applied, or by common bandages applied over a thick layer of absorbent wool, does good service. Friction is often useful, and induces frequently where pain and prostrate absorption. Care must be taken not to be misled by the presence of adhesions remaining after subsidence of disease into thinking that progressive mischief exists. A joint that has been acutely or subacutely inflamed, and after a week or two of treatment remains stiff, a little swollen, cold, and tender on pressure over one or two spots, with intense

joint at perhaps one spot or say somewhat beyond a certain point, *passive movement may be tried up to that point*, is the seat of adhesions, and requires bending down of these bands under chloroform. In such cases inquiry should always be made to ascertain that there is no evidence of any tubercular taint before treating the joint. After breaking down adhesions the limb should be kept quiet for twenty-four hours and effusion prevented by pressure or cold; and then, if all is quiet, both active and passive movement should be begun. While recognising the effect of adhesions in and about joints, it is well to remember that it is much less common to meet with cases of this kind among children than among adults or adolescents; probably because the restless activity of childhood prevents the joint from being kept still after the acute and painful stage is over.

When a joint has supplicated no premature attempts at procuring mobility should be made. As soon as the joint has been usually healed by a week or two all apparatus should be left off, and the child allowed to try for itself—left, in fact, to do as it likes, in reason—it will seldom do too much. If after a few days no progress in mobility is being made, chloroform should be given and the joint carefully examined. It is generally possible to make out whether the adhesions are few and cordlike, or general; in the former case a permanently stiff joint will almost certainly result, in the former the adhesions should be at once broken down. Where a stiff joint is arranged for, the limb must for many months, often years, be provided with a splint to keep it in the desired position. Children's joints are very slow to ankylose.

We have no great belief in inunction with Scott's ointment or dose of mercury, and painting with tincture of iodine, as modes of treating chronic joint lesions, but pressure and friction are invaluable when acute mischief has subsided.

In all cases of *typhoidal tuberculous* in the early pre-suppurative stage but one form of local treatment is, we believe, of much value—*absolute fixation*, with or without pressure. Where there is acute pain or a subacute attack in the course of chronic disease counter-irritants in the shape of blisters or the actual cautery are useful to relieve the pain, but we do not think they do any great good otherwise. We have tried and given up injections of iodine and carbolic acid into the pulpy tissue, and we cannot say we think Scott's dressing is of any great use, except as a means of pressure. For the upper extremity the plans mentioned for acute disease, combined with elastic compression, are all that is required; for the elbow and wrist the splint may be made permanent by fixing it on with plaster of Paris, or substituting light iron strips in the plaster for the wooden splint, or a poroplastic splint may be used. It is contrary to our figures of appliances for disease of the elbow and wrist in which the fingers are left free and can be moved—this seems to us opposed to all principles of keeping the joints at rest, inasmuch as every movement of the fingers must necessarily disturb both elbow and wrist joints. The joints of the lower extremity must be considered more in detail.

Treatment of Tuberculous Disease of the Knee Joint.—In early stages, where there is no dislocation and full flexion of the knee, the limb should be fixed upon a back splint with a foot-piece, and as long as the symptoms are acute the child should be kept in bed. If there is much

Swelling and pain the limb should be straightened gently under chloroform, and a splint then applied with an ice bag over the knee for the first twenty-four hours; where there is fever, but not much pain, an extension should be put on by a weight fixed with strapping below the knee,¹ or a Mader's splint may be used—we prefer the weight. As soon as the acute symptoms have passed off and the limb is nearly straight—it need not be quite so—Thomas's knee splint with patten and crutches should be provided, and the child allowed to get about; if there is much thickening, elastic pressure should be employed at the same time. Where the Thomas's splint cannot be obtained, or the friends cannot be trusted to look after the splint, or the child is too young to use crutches, a plaster of Paris casing should be put on, strengthened by the iron strips, as shown in fig. 230. As Mr. Paul of Liverpool has suggested, it is a good plan to cover the metal with rubber tubing. The child, if it is old enough, may get about with patten and crutches after the plaster of Paris is applied. Children under four years of age cannot usually be trusted to use crutches, and must be kept off their feet and taken out of doors in a perambulator or carriage. Good liver oil and iron, careful dieting, and fresh, pure air—the great medicine for rheumatic bones and joints—should be the general treatment where possible. As long as there is no suppuration a fair trial should be given to the plan described: it is simple, and we know nothing better. There must be no taking off splints for washing or to see how the joint is getting on—one movement of a joint may undo weeks of rest; leather and lace-up splints are for this reason not so good for hospital patients as plaster of Paris. Where the same can be trusted not to play pranks with the joint, such as allowing the child to bend it or stand upon the limb, washing is a luxury that may be occasionally indulged in, but fixation comes first. If in spite of this treatment the joint gets worse, operation is necessary; but in the case of the knee a very large proportion of patients will get better, and this because the disease is mainly synovial.

When a joint such as the knee, in spite of efficient treatment for two or three months, steadily gets worse, pain and swelling increase, and the child's health begins to suffer, more active means must be taken, and these will become necessary much sooner in acute than in chronic cases. If the pulpy material is rapidly breaking down, and suppurating, and yet the child's health is keeping good, success is sometimes obtained by fixing the limb on an interrupted splint, or better in plaster of Paris, and then opening and carefully draining the abscesses, taking care, if the whole joint cavity is suppurating, to drain at the back of the joint or at the lowest point of the abscess sac if the suppuration is localised. By this means a certain number of these children will do well and acquire sound, straight, and in some instances movable limbs. The plan is, however, only exceptionally applicable. If there is no suppuration, but the pulpy swelling increases, the best mode of treatment is Erasson's.

ERASSON. or, as it is now sometimes called, arthrotenomy, consists in the case of the knee opening the joint freely by a semicircular incision, just as in the ordinary mode

¹ One pound of weight for each year of the child's age up to six is a good general

of exposing the knee: the skin is reflected and the capsule removed on each side of the patella and patellar ligament, or, better, the patella is moved down and the ligament turned upwards and downwards; if necessary, two vertical incisions must be made as high as the upper limit of the synovial pouches. It is well not to draw up the skin from the underlying tissue more than can be helped, as the pressure of the dressing which should be freely applied sometimes interferes with the circulation in the edges of the wound and delays union. Next, every particle of pulpy granulation tissue is carefully scraped or scraped; all the inflamed capsule and the semilunar cartilages are removed and the articular surface scraped quite clean, any granulation tissue being carefully pushed out from pits in the cartilage, and, if necessary, any fat of disease in the bone scraped away. The process must be done thorough, and extreme force of the hand is required to fully expose and clean the back part of the joint: the crucial ligaments are scraped, but it would prostrated the lateral ligaments are divided. The upper wound must be thoroughly closed. The most difficult part of the operation is getting away the posterior part of the semilunar cartilages and the synovial membrane in the back of the joint. After thoroughly removing all pulpy tissue it is a good plan to apply the actual cautery in any doubtful spots. The process is a tedious one, often taking as long as half or two hours, including the subsequent putting up of a splint. As soon as all bleeding has been stopped the limb is fixed on an extension splint and dressed in the usual method, antiseptically. Drainage if used, should be at the back of the joint on each side, the tubes being carried through openings made behind the joint, but in more recent we have used no drainage and closed the wound entirely. When this is done it is important to arrest all bleeding as perfectly as possible. Usually bleeding throughout is primary union is obtained. We prefer to examine the limb, or at least put on an elastic tourniquet before beginning the operation. For a series of cases vide *Med. Times*, vol. 2, 1882. We recorded the operation in its complete form in January 1883, and the first case was that recorded and figured below. Mr. Greig Smith of Bristol had, however, he tells us, performed the same operation on an elbow in the previous year, but the case was not published until after our first case was recorded. There is, however, no doubt that Mr. Greig Smith was actually the first surgeon to perform craniotomy, though his case was the first published and his was unknown to us till long afterwards. We desire to give him full credit for his work.

CASE.—Lime N., age 13 years 9 months: old pulpy disease; joint covered all over with necrosis; much of capsule, semilunar cartilages, and a large patch of synovium removed; we will be a good deal of articular surface scraped away; result, a painful motion, sound, painless joint, used as freely as the other; ligamentum patellæ not divided. The joint under observation for nearly four years after the operation, and except that the was liable to occasional severe effusions, was both knees at a state of recovery, the remained well. The knee operated on differs little from the other except for the presence of the scar across it. In July 1883 this patient was again seen, and the knee remained perfectly sound and mobile.

Erasion, we think, is applicable to cases of fairly early disease which have resisted efficient treatment by splints, &c. Though in the case recorded we obtained a freely movable joint, we have never had such a perfect result since, nor do we think it wise to try for mobility, except in a few instances where the wound heals at once, and the adhesions are few. Erosion, if it fails, leaves the limb still fit for excision: where it succeeds, the limb is as sound as after excision, but without shortening.

The more we see of these cases, the more we feel sure that erosion is the proper operation, and that excision is hardly ever required, while the result is far better from erosion than excision. We prefer erosion, as above described, for the knee, but the general rules of treatment must, of course, vary with the particular joints, stability and absence of shortening being the cardinal points for the lower limb, mobility for the upper. More

wrapping through struts is of but little use, though if tubular steel they could be well cleared out.* Since the case above reported was operated on, many other 'arthrotomies' have been performed, and, on the whole, with very good results.

Should it be decided that the case is too far advanced for erosion, **excision** of the joint should be performed. Of several plans that we have tried we now employ most commonly the transpatellar operation. This operation was first employed by Volkmann, but was introduced to this country by Golding-Bird; it is an admirable method, and, we think, far the best that has been devised.



FIG. 176.



FIG. 177.

Show the condition of Lower N. after operation, and the free mobility of the joint.

A short anterior flap of skin is turned upwards by a curved incision running with its convexity downwards from one condyle across the apex of the patella to the other condyle; the patella is then cut through with scalpel or saw, according to the degree of ossification present; the lateral attachments are divided and the ligaments turned upwards and downwards. The lateral ligaments and capsule are freely divided, the bone surfaces cleared, and a thin section taken from the joint with a Bonnet's or sawing saw, care being taken only not to open up the cancellous tissue and not to touch upon the epiphyseal line. A section is then made through the condyles of the femur, exactly at right angles with the long axis of the limb, so that, when femur and tibia are brought together the limb is straight. It is important to remember that in the femur the epiphyseal line is usually said to correspond with the upper border of the articular cartilage, or with the line of the adductor tubercle; it may, however, as we have found, be below this, and it is not necessary in cases suitable for excision to take away so much bone as to approach this line. Where there is necrosis or caries deeply involving the epiphysis within section only should be removed, and the diseased part then ground away, leaving all the sound

* Vide *Rev. de Chir.* March 1883.

time. We have treated with a perfectly successful result, removing a segment from the lower end of the femur so large that it reached above the epiphyseal line. It is by no means necessary for success in excision of the knee to take away hardly from an inch and a half or so beyond study. We usually make the femoral section with a *Bonnet's* saw from behind forwards, but there is no special importance in the method of doing it. All the pulp tissue should be cut away, and all sinuous cavities carefully scraped out. The two tables of the patella are then sutured together with stout catgut or wire. A simple plan is to pass the catgut round the bone—i.e., through the quadriceps and the ligamentum patellæ—but in young children a suture will usually permeate the soft tissue so readily. The patellar ligament at the end of the operation often seems lax and redundant, so avoid this same support remove part of the patella; this is, however, unnecessary, as the parts soon adjust themselves. As to wiring the bone and knee together, as jugging them with steel or ivory pegs, or mortising the ends of the bone, pins to the plates may be in children and adults; in children they are unnecessary, as the ligaments swell and tight, and there is but little leverage. Further, the bones are so soft that one readily cut through and give but little more trouble; hence, though we sometimes employ these plans, we do not consider them by any means essential. When all bleeding has been stopped and the wound well powdered with iodoform and bone set in equal parts and dressed with wood-wool wadding, the limb is fixed on a splint. As to the choice of splint it is a much simpler matter in children than in older patients, since the limb is short and light, and displacement is much less likely to occur. We use generally an original interrupted wooden splint, and in the first or second dressing give iodoform and fix up the limb in plaster of Paris strengthened with wire strips. Heavy cotton splint, padded with wool-wool and fixed on with plaster of Paris or leucovar and padding, is a very good apparatus, but somewhat more troublesome to use. We usually mould the iron strips of Plaster of Paris splinting along the sides of the limb, round of the back and front. There is but less inconvenience with drainage should the wound not heal by primary union, and less difficulty in keeping the splint clean. Drainage of the wound should, if required at all, should always be through openings at the back of the cast—a diverticula or sump is thrust through from within at each side of the popliteal space, and then run down upon from outside; the whole of the incision wound is then able to be watched up.

As soon as the anæsthetic has passed off, opium should be freely given. As soon as the wound is healed, or in less favourable cases as soon as only sinuses remain open, the limb should be fixed afresh in a plaster splint or put upon a Thomas's splint, and in about two months the child may be allowed to get about with a pattee and crutches; but the case is by no means done with, since nearly every case of excision of the knee in children, unless thoroughly well looked after and a stiff apparatus kept constantly on for from two to four years, according to the child's age, will become crooked. Occasionally, after excision of the knee, a more or less movable joint has resulted, but we do not look upon this as an object so to be aimed at, but rather as a failure of the operation, inasmuch as flexion and extension are likely to result where no bony union is obtained. Flexion, with dislocation backwards and outwards, is the common deformity, but we have seen a general curve of the limb develop, or distortion at the epiphyseal line of the tibia. This deformity is the great difficulty and drawback in excision of the knee: the operation itself is not a very dangerous one: we did some twenty-five cases in children without a death, though some required subsequent amputation—this was the end of four of our first twenty-three cases. In recent years

¹ At the sixth year of the child's age is the usual time, and this should be recalled at all hours of need if required.

we have hardly ever excised a knee; this operation has in our practice been almost entirely superseded by excision.

The amount of shortening resulting varies much: in these cases, after an interval of about three years, it averaged 1½ inch. Though the results after excision of the knee are necessarily imperfect, it must be remembered that they are to be compared with prolonged suffering, danger to life, and amputation as the alternatives.

In neglected cases of disease of the knee, even though the disease may have to a great extent subsided, the joint often remains fixed and inflamed to such a degree that the limb is nearly or quite useless. If there is well-marked dislocation backwards, little can be hoped for in the way of reduction; all the tendons and ligaments become so shortened and contracted that, except in a recent case, little good can be done by extension or attempts at straightening—indeed, in some cases these attempts may make matters worse. Where there is flexion, but no, or only slight, displacement, extension by weights should be patiently used for some weeks; if no result follows, chloroform should be given and an attempt made to straighten the limb by forcible, though not violent, manipulations, frequent extension and flexion movements being employed to break down any adhesions in or around the joint. Should it be clear that muscular contracture is an important factor in the resistance, the tight bandstings should be divided, but we would dissuade from any violent efforts, especially if there has been much suppuration in the popliteal space: in such cases there is much risk of laceration of vessels. Should the attempt succeed, the limb is brought straight, fixed upon a back splint for a day or two, and then an immovable apparatus or Thomas's splint applied. Joints will often straighten when somewhat fixed and even when slightly dislocated, merely by prolonged wearing of a Thomas's splint.

Should it be found impossible to straighten the limb by these means, the choice lies between excision of the joint and osteotomy. We have employed both with good results, but they are applicable to somewhat different conditions. Suppose the joint allows considerable movement although it cannot be straightened sufficiently to be of use, osteotomy is likely to leave an unusable limb: on the other hand, an acutely flexed limb requires removal of a very large amount of bone in excision before the leg and thigh can be brought into a straight line. We think, then, that osteotomy is best for



FIG. 182.—Shows the result of permanent use of the limb after excision. The patient had been lame at another hospital, and the patient was subsequently admitted under the care of our colleague Mr. T. Jones. There was bony ankylosis in the position seen in the figure.

cases of stiff joint with great flexion, excision for those where there is more mobility, less flexion, and more displacement. The late M. Diers and B. Pollard advocate division of the crucial ligaments with subsequent reduction in cases of subluxation, and have recorded a few cases; we think the application of the method likely to be limited, since division of these ligaments certainly does not allow of reduction in all cases.

Osteotomy in such cases is not a difficult operation; a longitudinal incision is made about three or four inches in length on the front of the thigh from the patella upwards, the femur is exposed, and a sufficient wedge of bone removed from its anterior surface to allow the limb to be brought straight. We prefer this plan to simple section, which may cause dangerous pressure on the popliteal vessels, and be followed by gangrene. In one of our cases after various we could not nearly straighten the limb at the time, but by keeping up extension after the excision the limb was gradually brought almost straight. The following case illustrates the value of osteotomy in certain circumstances:



FIG. 122.—Position of limb of the Ankle and Tarsus. It is made of iron, covered with indiarubber tubing, as suggested by Mr. Ford. The splint is fixed to the limb with pieces of raw hide.

Case in Nervous Palsy.—Angular Flexion of Knee Contracted.—Ridgely R., age 13 years; admitted January 18, 1875. History good; well till two years ago; composed of pain in knee, which soon resulted in knee becoming stiff; discharge has continued till now. On admission, well-nourished boy; was sent in for amputation; the left knee is enlarged and larger than the right; on the inner side are scars of former operations, and a large tumor on the upper end of the bone; the leg is fixed nearly to a right angle; hamstrings tense, too pointed; knee cannot be straightened. 24th, has had a few extensions on the abdomen, but the knee is no straighter. Finally he has had on a Thomas's knee splint since last week, and has been getting up; no improvement. 24th, under chloroform an attempt was made to straighten the limb flexion; a few adhesions gave way, but no sensible improvement followed. 26th, as tumor 3 inches long, was made in the axis of the femur above the knee, the periosteum was peeled back, and a large wedge of bone removed with an osteotome; the limb could then be nearly straightened; operation successful. 26th, tube removed. March 15, limb put up in back splint with movable foot-piece; wound healed and limb straight. 26th, fine scars of chest; leg straight; foot in good position; got up with the Thomas's splint. Next home on 24th. January 20, 1876, leg straight, walks without splint, wound well; toes still somewhat pointed.

In another recent case the joint was much flexed, but mobile through a certain range; on excising the joint it was found impossible to straighten the limb without greatly shattering it, so an osteotomy was done at the junction of the lower and middle thirds of the femur, and the limb was then brought into good position.

Treatment of Pulpy Disease of the Ankle Joint.—The same general rules apply to the treatment of tubercular disease of the ankle as to that of

or knee in the earlier stages of the disease, and many good results will be obtained by simple pressure and fixation. To carry out this plan the best means are to use either the apparatus shown in fig. 130, or a short metal tuck splint with a foot-piece, the child being allowed to get about with a Thomas's knee splint. Should suppuration occur, and the joint not recover by the means described, the prospect is a somewhat poor one: however, amputation and resection of the ankle for tubercular disease are now fairly satisfactory operations, though the disease sometimes spreads, and amputation is required. Amputation is, however, in these days almost a discarded operation, except at the hip joint, at least so far as the surgery of childhood is concerned. We have not amputated a limb at the Children's Hospital for joint disease during the last three years, except in one case where the mischief in the knee was the result of extension in a case of acute necrosis. A patient trial of fixation, pressure, and, if necessary, repeated removals of the disease should be given, even after suppuration occurs, provided the child's health is maintained, but the prospects of such cases in disease of the ankle are not nearly so good as in the knee. The following is an instance of a satisfactory result after erosion of the ankle:

CASE.—Poor M., age 3 years 2 months; admitted January 23, 1884. Ten weeks ago the right ankle became swollen; no cause known; had been treated with cold water, wrapping, &c.; never had much pain in it. On admission, fairly rounded but mainly conical-shaped leg; there was much swelling round the right ankle joint on all sides, with increased heat and redness on the outer side, but little or no tenderness on pressure. Though movement of the joint was possible; the circumference was an inch and three-quarters greater than the opposite side; the position was semi-extended and rotated slightly inward. On February 3 the joint was opened by a transverse incision (Mr. Holmes's plan) across the front of the foot, dividing all the extensor tendons, &c.; much pulpy synovial exuded with "coloured water;" all the pulpy tissue, as well as the loosened cartilage, was removed in far as possible, and a drainage tube passed across the joint, a groove being cut in the upper surface of the cartilage to prevent the tube from being slipped; the incision was then pulled together with silver and the wound closed; no attempt was made to immobilize, and the anterior tibial artery was retained; sponge pressure was applied around the joint, and the operation was antiseptic. Finally the foot was fixed on a tuck splint with a foot-piece; a little swelling followed at the first dressing; on the following day the appearance of the foot was natural below the line of incision, a little superficial abscess occurred at the outer apex of the front of the foot, and when the edges were close, but by March 13 the incision had healed except at the drainage-tube opening; no pus had been discharged up to this date. On April 20 some tenderness was perceived on the inner side of the foot. There was no discharge, and on May 21 he was sent out with plaster of Paris over an Emmert's splint and a sponge dressing still applied; after this progress was very slow, some thickening remaining about the ankle, and occasionally a small part of the osseous shell ulcerate and break down. February 1885, less wound and with but less are somewhat present, and he "thinks" the foot is walking. He gets about well with a stick and without any support. A good deal of new bone formation along line of incision, but some mobility.

We have also had some excellent results after excision of the ankle.

CASE.—*Nurse of Right Ankle.* *Nervous of Ankylosis.*—Edward L., age 4 years 1 month; admitted September 28, 1884. Family history good. History: Well till six months ago, when the ankle began to swell and has gradually got worse, no pain; no injury; can walk. On admission, fairly healthy child; somewhat emaciated; right ankle swollen; bulging on each side of corner tendons and round each malleolus, especially on inner side and in front of tibia & fibula. September 30, ankle joint opened; a little

army, those of antiseptic to such extent. October 22, an improvement; no action behind the knee sufficient gave out in two transverse of patella and almost total ankylosis ensued. October 25, wound healed; joint red-hot. November 15, temperature 104.2° in a.m. November 23, joint opened; a large bone sequestrum of the astragalus was found and removed; the other astragali were then taken away and the lower end of the tibia and fibula removed, as well as the upper surface of the os pubis and the inferior iliofemoral joint. The joint was opened by a transverse incision across the knee; the tibia and osseous tendons were stitched together afterwards. Operation anæsthetic, compression, and subsequently a saline etc. January 15, temperature 104.4° in a.m. foot being badly, but slowly, still some swelling. February 15, and out in plaster. Five days in new plaster band foot; wound not healed. He finally got a good new foot.

If excision is performed the astragalus should always be retained entirely and all fibrous alar material taken away; there is then a fair prospect of a good foot, and only when this fails should amputation be done. The prospects after excision are much better now than they were before recent improvements in the management of such cases. We have had some very satisfactory results after Pirogoff's operation, and watched them for years; and, although it occasionally fails, where it is successful it gives a much better stump than Syme's amputation. If removal of the foot is too long postponed, disease is apt to spread up into the tibia and along the sheaths of the tendons, and then amputation higher up the limb will be called for, but the question of amputation, as already pointed out, very rarely arises. See also treatment of Tarsal disease.

Treatment of Tarsal Disease.—It has already been pointed out that, except in the case of the os calcis, disease of the tarsus is usually symmetrical in origin; hence it should be treated on the general principles of such lesions—absolute fixation of the foot, with entire rest from any strain—and the usual hygienic means should be employed in addition. The apparatus already referred to for disease of the ankle is the best means with which we are acquainted of carrying out this plan, and to it a patient trial should be given. Should, however, this treatment fail, two courses are open: one that of complete removal of the disease by amputation, the other that of removal of the diseased parts alone. It is impossible here to fully discuss the question, but the conclusions to which our experience has led us are these. If there are definite sequestra of one or more tarsal bones, these should be removed, and an attempt made to save the foot; the fact of there being sequestra often means that there is a line of demarcation formed and recovery may follow. It cannot be stated absolutely, because, as already pointed out, in the case of the leg, even where sequestra exist tuberculous infiltration of surrounding bone may be present. If there is general symmetrical disease with caries, it is best to freely expose the affected parts by turning up a dorsal flap of the soft structures and removing the diseased tissues, but so long as any affected epiphyseal membrane or carious bone remains secureness is to be expected. In such cases the best plan is total resection of the tarsus—i.e. removal of all the tarsal bones, with or without the exception of the back part of the os calcis, which, if sound, may be left to form a support for the heel.

The simple transverse dorsal incision turning up a dorsal flap is, as I think, the best method; it fully exposes the parts, the flaps and tendons can be stitched together afterwards, and the use of the foot is wonderfully little impaired. After the operation the foot may be at first kept loosely upon a back splint with a compress, but as the cavity begins to fill

up and the parts consolidated; the iron splint (Pau's splint) with plaster of Paris fixed the foot upright.

By this method excellent results, far superior to those obtained by a Paragoff's or Syne's amputation, will be obtained (fig. 171).

CASE.—Anne E., age 27, sprained her foot in the winter of 1884-85, and came under our care in the Royal Infirmary in November 1886. She was then a fairly healthy-looking girl, with disease of the anterior calcaneo-scapuloïd and astragalo-scaphoid joints, as well as swelling of nearly the whole foot; there was a line below the inner malleolus. After treatment by rest and friction part of the scapuloïd and scaphoid were removed in January 1887. In May the disease was still progressing, and the skin of the tarsus, with the exception of the posterior part of the malleolus, was taken away, the bones of the metatarsal bases and the malleoli being also removed; some of the tendons were stitched together, otherwise no attempt at adjustment of the deeper structures was made. In the spring of 1888 the foot was as seen in fig. 172: the "spring" upon it is a rubber castor; there was fair sensibility and power; and she did her movement with no other support than a Mott's bandage.—*Yours truly*, Chas. September 1888. In 1889 the foot still remained small. We have had a good many similar cases.



Fig. 172.—Shows a foot after resection of the whole tarsus on the left side except the back of the malleolus. Anne E. Right foot smaller.

Should the disease recur, amputation may possibly be required, but this is far less likely to be necessary than after mere gouging or scraping operations.

Partial resection of the tarsus, *enligt* for *Micula*, is rarely successful: i.e. where there is mischief spreading about among the tarsal joints it is of little use to remove merely an individual bone or two bones. Unless a clean sweep is made of the disease it will probably recur. The exception to this rule is the os talis, but as in this bone the disease is usually central, it stands by itself; removal of the entire os talis without any other bone is a highly successful and very valuable operation, and is often called for.

CASE.—*Disease of Calcaneo-scapuloïd Joint. Caries of the Calc. Evulsion.*—Norman G., age 27 years 4 months; admitted June 21, 1889. Family history: phthisical. History: smaller ten years ago; swelling of foot followed; has been under treatment for 8. On admission, tumor in sole of right foot over calcaneo-scapuloïd joint, another below inner malleolus; much thickening about os talis, movement of ankle free. June 24, explored: came into into os talis, and partially to calcaneo-scapuloïd joint; drainage. July 7, put up in plaster of Paris with ankle splint and discharge; splint had to be removed in a few days on account of swelling; ankle splint put on; had cautery July 18. Re-examined July 24, foot worse; discharge increased. August 1, sup turned; kindly from foot, and os calcis removed; found caries, with a large artery; operation re-operations; did well; discharged August 25. February 1894 the foot looked well; tumor cured and cured; a small fresh collection of pus has, however, just returned; the os talis has been largely reproduced, and the foot is fairly well shaped. May 1894, well and well; walks extensively.

The treatment of tarsal disease, then, is rest and pressure first; failing this—and it should have full trial—removal of exostosis if there are any; if not, resection of the whole tarsus, or at least of such part of it as shall include all the joints communicating with the seat of disease. If disease still goes on, Pirsgoff's or Syme's, or, of course early, Chopart's operation, as the disease may demand; for disease of the os calcis removal of it alone is the better plan, and when done subperiosteally there is usually a most perfect restoration of form (fig. 132).

After total resection of the tarsus we much prefer to keep the foot in its natural position and allow the parts to adjust themselves, rather than artificially produce a sort of equinus foot as proposed by Wladimiroff.



Fig. 132.—Shows the result of resection of the Os Calcis. There is nearly complete restoration of the foot.

Canine, in a paper in the *American Journal*, of Jan. 5th October 1893, publishes two cases of resection of the tarsus in which two or more bones were removed, including not even of his case in which the entire tarsus was taken away through an incision along the inner side of the foot. He concludes that the mortality is not much. If it all, greater than that of amputation at the ankle joint, then it can be followed by amputation if necessary, and a lot of the best cases the result will good. A paper by one of the present writers in the *Medical Chronicle*, 1895, may also be referred to.

Disease of the phalanges and metatarsal bones of the toes differs in no way from the corresponding disease of the fingers, and requires the same management except that amputation may be resorted to in the foot earlier than in the hand, since the loss of a toe is of less consequence than that of a finger.

Disease of the first metatarsal bone and of the metatarsophalangeal joint of the great toe is common, and of importance, since it is liable to be followed by considerable lameness. Failing rest and general measures, the question of amputation or resection remains; either is followed by a considerable amount of crippling, but resection of the first metatarsal bone is so frequently unsuccessful that the most speedy satisfactory result is probably that of amputation. We usually resect the bone as a first resort, and only amputate failing this; but we must confess that even when resection succeeds the toe is so shrunken and short as to be of little use.

Sacro-iliac Disease is not very rare in children; it is usually, we think, the result of extension of chronic tubercular disease from the adjacent bone, most often the ilium—at any rate, necrosis is common, and we have many sequentia which included the articular surface of the ilium. The disease usually runs a chronic course, and gives rise to comparatively little pain; often attention is first called to it by the presence of an abscess over the back of the joint; sometimes, however, the matter forms at the intrapelvic surface and may point in the groin or track down behind the rectum; under such circumstances there may be pain down the leg from pressure upon the neural nerves. Pain is sometimes felt in walking from the weight of the body bearing upon the diseased joint, and pressure directly upon the joint or upon the

the crests, or, again, traction upon the iliac crests, tending to draw them backwards, gives rise to pain. It is occasionally possible to make out mobility of the ilium upon the sacrum, and we have seen displacement of the bones as a result of disease. Cases of the spine may cause sacro-iliac disease from the burrowing of pus into the joint, and in most of the cases we have seen there has been disease of bone or joints elsewhere.

Sacro-iliac disease is best treated by rest in bed on a firm mattress, no sitting up being allowed. Should an abscess form and increase in size in spite of treatment, it should be opened and any diseased bone removed; as soon as the acute symptoms, if any are present, have passed off, the child should have a double Thomas's hip-splint applied, the splint being fixed on with plaster of Paris round the hips and above the joints; he may then be moved out of doors on a couch with safety. If the position of the abscess prevents the application of the splint in the ordinary way, the apparatus may be so arranged that on the affected side the splint is applied to the outside instead of to the back of the limb (vide figs. in chapter on SPINAL DISEASE). If the child recovers, there will probably be some arrest of growth of the pelvis on that side, and a lateral curvature of the spine.

We have not seen a case of acute non-tubercular sacro-iliac disease, and the strength of the articulation is such that any acute traumatic mischief is unlikely to be met with.

Disease of the Temporo-maxillary Joint occasionally occurs in children as the result of scarlet fever, injury, or necrosis of the jaw or of the temporal or malar bones, or arises by extension from the ear, and gives rise to stiffness and inability to open the mouth, and later to distortion of the face from arrest of growth. Pain in movements of the jaw and swelling over the joint are the usual symptoms; when suppuration occurs it usually points over the articulation. We have seen the joint suppurate in a case of pyæmia which was associated with acute suppurative arthritis in an infant.

The treatment consists in opening the abscess, should one form, and the child should be fed on soft food; unnecessary disturbance of the joint is to be avoided. Should the jaw become stiff, attempts should be made to overcome the stiffness by means of a Maudsley's screw, used several times daily after forcible opening of the mouth under an anæsthetic, just as in peri-articular adhesions from suppuration in the neighbourhood of the joint.

Case.—Scurvy. Atrophy of Jaw, with Abscess of the Bone.—Thomas C., age 4 years, 4 months; admitted June 21, 1882. Had fever and inflammation of the lungs in two years old, and since then his jaw has been stiff, so that he lies on his side and yawn; was thought to have hydrocephalus; soon after he became ill he had stomatitis, which continued until the time of admission with intermits. On admission was only able to open his mouth about a quarter of an inch; nearly all his teeth were carious, heapily null and seemed to be in good health; the jaw was much atrophied, so that the upper teeth lay overhanging the lower; the jaw was forcibly pulled open under chloroform, and subsequently Maudsley's screw was used, with the result of increasing his gape to more than an inch, and swelling due to hæmorrhage daily well; the use of the screw has been continued up to present date, February 1883.

Failing this plan one of the forms of operation for the establishment of a false joint should be performed; probably the most satisfactory is permanent results is resection of the head of the bone by an incision parallel to and

below the zygoma, taking care to avoid injury to the facial nerve, but we have not met with a case requiring the operation.¹

Disease of the Acromio-clavicular and Sternoclavicular Joints is occasionally met with; it should be treated by fixation of the arm to the side. If suppuration occurs the joints should be freely opened and the tuberculous material removed. We have found sequestra in the acromio-clavicular joint (*vide* GENERAL SURGICAL TUBERCULOSIS). A certain amount of disability in use of the limb may result.

'Hysterical Joints' (*vide* chapter on HYSTERIA). Though the utmost caution must be used before deciding that any joint trouble in children is one due to organic disease provided persistent complaint of the joint is made, it is an unquestionable fact that cases of so-called 'Hysterical joints' are occasionally met with. We have seen children with such a condition affecting the spine and more rarely the hip. The great clue to the nature of the case is the incompatibility of the objective signs with the complaints made by the child. If with a history of long-continued complaints there is no localisation of disease, and if the site of the alleged pain is inconsistent with the known nerve distribution, and if also the pain is exaggerated, we should carefully consider the possibility of a 'neurosis,' and then the more if the personal and family history supports such a view. We have recently (1895) seen a girl of about 12 years of age, who a fortnight after being sent to work complained of pain in the hip and subsequently in the knee. She was supposed to be suffering from hip disease. On examination she was a stout, healthy, but excitable-looking child. She walked a little lame, and complained of pain in the region of the anterior superior spine of the ilium and in the knee. There was neither swelling nor rigidity of the joint, but alleged great tenderness on pressure. Further examination showed that pressure on various other points gave rise to extreme expression of pain, but by leading questions complaint could be elicited of pain in other parts of the body where there was no reason at all to suspect the presence of disease. The complaints were incompatible with what we know of organic disease, and the case was clearly shown to be hysterical.

¹ Dr H. Spence's plan of dividing substantially the existing structures is well around the joint (*vide* Mr. C. Hart's lecture, *Brit. Med. Jour.* Jan. 2, 1895).

CHAPTER XXVIII

HIP DISEASE

Hip Disease—In the ordinary sense of the term—in, *tuberculous disease of the hip joint*—is almost entirely an affection of childhood; thus only 73 patients, the subjects of this disease, were over twenty years of age out of a total of 619 cases collected by ourselves, and probably in some of these the disease had begun at an earlier age. It is somewhat more commonly met with in boys than girls, and is much more frequent among the poorer than in the well-to-do classes. Mention has already been made in general terms of its pathology and causation of the disease—that the hip may be taken as the joint in which primary tuberculosis of the bones forming the articulation is



FIG. 111.—Diagram showing at *a*, a vertical section of the parts most commonly affected in Hip Disease: *a* is the greater trochanter. The lower *a* points to the tubercle. (Adapted from Barwell.)



FIG. 112.—There is a large impression in the neck. The head, which is still cartilaginous, but is almost detached, is supported up by a nail. Vascular perforations are seen in the marginal cartilage. Remove and examine.

most frequent. Indeed, our own belief, based mainly upon examination of some 150 cases of excision of our own, is that in true chronic morbid cases, such as we ordinarily see, and also in the acute and rapidly destructive cases, the disease begins almost invariably in the bone. In older patients a primary synovitis is more frequent, but in children an acute, subacute, or chronic inflammation of the upper epiphysis of the femur or its neighborhood is by far the most common condition. In some cases the disease begins in the neck of the femur, and when this is so it is generally the under surface that is attacked, and this is the part on which the greatest strain comes in injuries

* For a more detailed account of Hip Disease in Childhood I refer you once again to the reader is referred to the monograph by one of the present writers: *Hip Disease in Childhood*, by G. A. Wright (Longmans & Co., 1897). Also the work by Dr. R. W. Lewis of Boston, *op. cit.*

applied direct to the trochanter, and also the part least abundantly supplied with vessels (figs. 133 and 134).

In some cases the disease is primarily acetabular, but much more frequently the initial lesion is femoral, though rapid destruction of the acetabulum may occur secondarily. In our hundred cases of our own the acetabulum was diseased or perforated in twenty-seven, but in many of these the disease was probably primarily femoral. The part of the epiphysis usually first involved is the immediate neighbourhood of the epiphyseal line. The occurrence of synovitis of the hip-joint is not, of course, denied by us, but we believe that two entirely different classes of cases come under observation: the one is a simple synovitis, usually traumatic, a lesion that occurs in the healthy and unhealthy alike, and is as amenable to treatment in the hip as elsewhere. The other class is one composed of tuberculous patients; from some injury, or even slight overstrain only of the part, the cancellous tissue of the bone has its normal circulation slightly interfered with; inflammation follows, and inflammation in a tuberculous subject is only too prone to follow the usual course of a tuberculous lesion, and the special anatomical features of the hip-joint make it especially liable to serious and progressive disease. Necrosis of the pelvis or femur is common in the course of this disease: thus in our first hundred cases of excision there were seventeen instances in which sequestra were found, either in or detached from the femur, and the acetabulum contained sequestra in twenty-two cases.

The most characteristic and typical specimen from hip disease in an advanced stage are the following. The cartilage is all gone or hanging in tags, or screw-driver planes; it may be merely loosened and thinned with a layer of granulations underlying it (fig. 131); the synovial membrane is red and vascular, somewhat thickened, but more in swelling like the degree already described in the case of the knee joint. The bone, as seen in section, seems somewhat, but certain characters are very constant. Sometimes the whole upper epiphysis is detached and forms a hard, brown, marble-like separation; in a large number the upper epiphysis is destroyed to a greater or less extent; sometimes only a small part of it is actually gone, but by all it is of a dull yellowish-white colour. In some late cases the colour is opaque, and the bone is gutta-like, with or without obvious necrotic areas; in other cases there is a marbled appearance, patches of dark red hyperemic tissue alternating with dull yellow areas, all here and there a soft patch of granulation tissue. No sequestra can be present, and the epiphyseal cartilage may be held almost, perforated, or entirely destroyed.



Fig. 131. There is exposure of both sides of the epiphyseal line. The whole surface of the bone—the rough depression measured by pressure against the rest of the acetabulum. There was pathological calcification. A section has been made through the upper end of the bone.

Occasionally the disease spreads far down the shaft; more commonly the bone below the level of the great trochanter is congested, with more or less rarefaction, but no extensive disease. Corresponding lesions are found in the acetabulum, which is often rough and eroded, and its walls absorbed, so that the cavity is wider and shallower than in health. Occasionally there is very extensive caries or necrosis of the pelvis, and, indeed, nearly the whole innominate bone may be diseased. It must be remembered that even when the pelvis is perforated there is a thick wall of dense fibrous material

intervening between the pelvic organs and the joint cavity, so that, although the bone is bare on both aspects, and much of it requires removal, there is no danger of injury to the viscera. The joint itself usually contains pus and thick membranes, with broken-down caseous granulations and debris. The ossifications commonly found in the acetabulum have been already mentioned; it should, however, be stated that in the later stages of the disease what is called 'travelling ankylosis' may be produced where repair to some extent is going on; the rim of the acetabulum is destroyed by what looks like a sort of plugging-up process, and when repair begins new bone is formed higher up in the domain of the ilium to form a socket for the end of the femur. In some instances the innominate may be separated into its component bones, as in two specimens in our collection. (See fig. 136.)

In other cases separation may occur within the pelvis, either as a result of perforation of the acetabulum or of extension of inflammation through the thickness of the bone, or of pus, as it not infrequently does, tracking over the level of the pelvis and then gravitating downward. We have seen several cases where pus has burrowed up the sheath of the psoas and so got within the pelvic cavity.

The remains of the head of the femur may lie in the little-altered acetabulum, or be driven upward upon the ilium, or even project through the ankylosis into the pelvis; it has been found fixed to the acetabulum, though quite detached from the femur, or, rarely, firmly impacted, as we have seen it. The amount of acetabular disease depends, apart from the possibility of the origin of the affection there, upon the fact that when once the joint cavity is involved, a large surface—i.e. the whole acetabulum—is at once exposed to irritation, and so the process in it is more rapid; it also depends upon how much the head of the femur has been allowed to press upon the pelvis.

It is very rare to find any attempt at a new formation of bone while the disease is progressing, while, after removal of the upper end of the femur, new bone may be rapidly formed; in this, of course, the hip resembles other joints. This rapid formation of new bone after excision is a strong indication for that operation, in that it shows that nature is unable to begin repair until the disease is removed.

The etiology and pathology of *morbus coxae*, then, may be summed up as follows:

1. Hip disease is dependent upon that deficient power of recovery and tendency to caseous degeneration which may be called the strumous or scrofulous, or, better, the tuberculous diathesis, and this constitutes the predisposing cause. The disease is, in fact, a local tuberculosis.



Fig. 136.—Morbus coxae. The ilium is completely detached from the other two bones, and is largely necrosed, while scrofulous patches of new bone are seen on the surface. The ilium was white.

3. Any slight or severe injury, even one, &c., or the onset of a specific fever, may, in such a constitution, prove an exciting cause.

5. Injury in a healthy child may produce synovitis, or even acute inflammation of bone about the hip, as elsewhere, but this does not, except very rarely, lead to chronic hip disease.

4. In the vast majority of the cases of *tubercles* about the joints begin as an osteomyelitis of the upper epiphysis of the femur, or of the immediate neighbourhood of the epiphyseal line.

5. This particular osteomyelitis tends to destruction, and usually runs a chronic course with cessation of the inflammatory process, and resolution can rarely, if ever, be expected when the disease is well established.

6. The occurrence of the disease in childhood is explained by the physiological and anatomical peculiarities existing before puberty.

Besides the common chronic hip disease, there is a form of **acute hip disease** which may run its course in a few weeks or months, and produce as much or more destruction of parts than months or years have in the chronic cases. Instances of this condition are not very rare; every hospital surgeon sees them occasionally. Some of these cases are probably pyæmia, others belong to the class of 'acute suppurative arthritis of infants' (vide p. 637); others, again, are acute traumatic inflammation, even if it is osteomyelitic; possibly in some partial separation of the upper epiphysis may occur, with rapid necrosis; others, again, are probably cases of acute peritonitis of a nature similar to that occurring in the shaft of the femur, ilium, &c. These last may result in widespread suppuration and necrosis of the pelvis and femur. An acutely destructive condition may come on in the course of chronic disease.

Lastly, acute tuberculosis sometimes leads to rapid suppuration.

Symptoms.—In describing the symptoms of hip disease it will be convenient to take them one by one, and discuss the views and explanations of each symptom before passing on to the next, and finally to group them together in a type case.

Pain.—Pain is a prominent feature of most cases of hip disease from the beginning; at least until complete disorganisation of the joint and displacement or destruction of the head or recovery.

The seat and degree of pain are, however, often very variable. The pain may be referred to the hip itself, the buttock, the back or front of the thigh, the knee in front or behind, or any part of the leg or foot. It may be localised or diffused, so that the patient strokes the whole thigh down or some cases when asked where his pain is, and but rarely points to any one spot. There is no consistent relation to be made out between the seat of pain and the position or extent of disease. Probably the front and inner side of the knee is the most frequent seat of pain. Tenderness, however, is often much more localised to the position of the joint, but even that is very variable. Pain is, undoubtedly, often remittent; sometimes an interval of some weeks intervenes, even without treatment, between the attacks. We have seen cases where the child had been walking about with a shortened, distorted limb, who never had any pain from beginning to end; and others, with large abscesses, who have also been throughout free from pain; while the agreeing pair of those who have to

where 'night startings' is only too familiar to all who have been residents in hospitals.

In considering the question of pain, it is well to bear in mind the number of different sources of nerve supply to the joint.

It is not practicable, nor very important, to distinguish by a knowledge of the nerve distribution the exact patch of synovial membrane or ligament that is locally inflamed: its only value, if it were possible, would be from a prognostic point of view; but here history, duration, and other symptoms are more trustworthy. There is, however, no doubt that 'night pains' give evidence of extension of the disease to the articular surface.

It is, then, clear that pain in cases of hip disease is variable in its seat, or rather that it may occur in a great many different places; of these, special attention has always been paid to pain in the knee, and several explanations are given of this pain. In the majority of cases it is probably due to 'transferred sensation' from one of three sources, the anterior crural, the sciatic, or the obturator nerves, branches of which are distributed to the front and back of the joint. In our experience, the pain in the knee is generally rather vaguely referred to the front of the knee, the child posing its out-stretched hand over the whole of the front of the joint. The pain, in fact, is referred rather to the distribution of the anterior crural than of the obturator.

Pain in the hip is not usually a marked sign in the sense of there being any constant pain; tenderness on pressure over the front or back of the capsule, and pain in pressing the trochanter inward or the head of the bone upward, is, of course, present in all acute cases, and a large proportion of the chronic ones.

Night startings or *pains* are a prominent and important feature in acute and subacute cases; they may be altogether absent in chronic disease—except where anile muscled has supervened upon chronic—and they may be absent throughout the whole course of a case. When they do occur, they indicate that inflammation has extended to the joint surfaces; and further, that our means, whatever they may have been, of treating the lesion, have been inefficient so long as these startings continue. Their cause is too well recognised to need discussing. The rigid muscles, acting under the influence of 'joint sense' (Barwell), contract spasmodically to fix and immobilise the joint surfaces; as they come on, with its accompanying muscular relaxation, some friction or pressure of the tender surfaces together takes place, causes acute pain, a sudden awakening with a cry, and a violent spasm of the muscles to again fix the joint. This may be repeated many times in a night, and is a strong indication for treatment. These night pains are very uncommon after excision; when they do occur they mean that disease is extending in the pelvis, and probably the femur is not kept sufficiently far away from the acetabulum to prevent pressure upon it; in such cases, then, it is well to increase the extending force, though in some cases too great extension may increase pain. Tenderness or pain on pressure has been already alluded to. When superficial tenderness really exists, the fears of the child, if he has already been ungently handled, being taken into account, it means that suppuration has occurred in the soft parts and is becoming superficial, or, in very acute cases, it seems that usually all the parts in the neighbourhood of the joint are hyperæsthetic; it is certainly

the case that in no joint does inflammation extend so widely among the soft tissues as in hip disease.

When, however, no pain is produced, except on deep pressure applied over the head of the bone, it is probable that the disease is limited to the bone, and has not yet set up mischief of any serious nature within the joint, or, at least, that any such change is a very chronic one. It is well to bear in mind that pressure on an inflamed ligament is very painful indeed—a fact easily verified in chronic synovitis of the knee—and it is possible that the pain in these cases may be due to extension of the disease to the capsule rather than to the inflammation in the bone itself.

Certain movements of the joint are more painful in case of inflammation than others, and it is true that a patient may have quite or almost perfect power of flexion of the joint, and yet be quite unable to bear rotation or abduction.

Night-startings may exist and be due to hip disease without any accumulation of pain on awakening; but Howard Marsh cautions against mistaking the cries of nightmare for those of night-starting.

It is well to remember that inflamed inguinal or iliac glands may cause painful tenderness, which must be distinguished from that of the joint itself.

Lameness.—Limping or lameness is the symptom usually first noticed by the parents in the case of children with chronic hip disease. Even this, however, may be preceded by a feeling of tiredness or ill-defined aching about the limb after exercise, the aching passing off after rest, but recurring again after less and less exertion. The limping may be quite painless at first, and differs in appearance from the well-marked 'drop' seen in later stages, when there is shortening of the limb. At this time the child proudly shows a tendency to rest the affected leg, and throw the weight upon the sound limb at every opportunity. Later, well-marked lameness comes on, and is accompanied by pain. It is at this time that the mistake in diagnosis is so often made; the obvious symptoms are lameness, and often pain in the knee or thigh; there is no other marked sign, and the condition is supposed to be disease of the knee or 'weakness' with 'growing pains,' and so on.

This stage requires careful and exact investigation to discover it, and at the same time is the period at which treatment is most effectual. Later in the disease lameness is due either to actual shortening, or to tilting of the pelvis to take the strain off the tender limb, or to flexion.

Heat.—Increased temperature in the joint is, of course, only perceptible where the inflammation is acute, and from the thickness of the parts covering the joint is not readily ascertained; it is not, therefore, a symptom of much value, except in the third stage, where superficial swelling combined with heat indicates the presence of suppuration outside the joint. In some cases of acute synovitis, pure and simple, a local rise of temperature may be made out, and is a valuable indication of acute inflammation of the soft tissues.

Swelling.—Swelling is one of the most important symptoms. In the first place, local swelling over the front and back of the joint—i.e. just external to the femoral vessels on pushing them forward, and just behind the trochanter, obliterating the normal hollow—indicates effusion into the synovial sac, and, with a recent history of injury, indicates an acute synovitis.

With a longer history such swelling is due to the secondary inflammation of the joint by extension from osteomyelitis.

Swelling of the great trochanter indicates suppuration, or rather extension within the joint, and when well marked we believe may be relied upon as pathognomonic of it; it is true that this thickening may disappear under treatment, but none the less has there been puriform material there which has been absorbed as far as its fluid portion goes, and if once that thickening has occurred we do not think any case is free from danger of relapse. This thickening results from extension of the disease from the interior of the bone to the surface, and, as soon as the cavity of the joint is involved, suppuration almost invariably occurs, though of course not necessarily outside the joint.

Pyarthritic or 'adocent' abscess certainly does occur, but not so commonly, we think, as some writers describe. Swelling of the inguinal glands is considered by Mr. Barwell to indicate sepsis. We would go even further, and say that when considerable it often indicates disease of the pelvis rather than of the femur. It is common to find some enlargement of inguinal glands in tuberculous children, but we think they seldom suppurate unless the pelvis is diseased. The condition of the iliac glands will be noticed again.

Muscular Spasm.—Spasm of the muscles around the hip is, as in the case of other joints, an almost universal condition—quite universal, if we except those cases of osteomyelitis where the inflammation is as yet limited to the bone, and the few cases where the joint is slowly and painlessly disorganised—cases already alluded to under the section of pain.

The spasm is due, as is well known, to two causes: reflex spasm from irritation of the terminal nerve filaments supplying the articulation, the stimulus being reflected in accordance with Hilton's laws to the muscles moving that joint—Barwell's 'joint sense'; and secondly, a voluntary contraction of the muscles to prevent movement of the painful surfaces the one upon the other.

It is well known to what the particular position of the joint in disease is due: flexion and abduction, as long as it remains a closed cavity, is the position of least tension, and therefore of least pain; the aggregate mass of flexors, too, is stronger than the extensors here as elsewhere, so that flexion is the position of rest.

The rigidity of the spasm is very great indeed, so much so that in many cases, without painful manipulation, it is impossible to say from mere physical examination that the joint is not ankylosed. In most cases, however, there is a certain limited range of movement allowed through, perhaps, 10° in the middle of flexion, and in many cases a considerably larger range, while in some it is only in extreme flexion and extension that spasm relaxes.

Nocturnal spasm has already been alluded to under the section of Pain.

Flexion or Rigidity.—Flexion of the joint, apart from muscular spasm, may depend upon any one of three causes, but can only exist in the second or third stage of the disease, or as a result of quiescent or cured disease. The causes are adhesions within or around the joint, moving together of muscles so that their power is lost, or bony ankylosis. Chloroform at once reveals the nature of the rigidity, whether it is due to mere muscle spasm,

when, of course, it will disappear; or to adhesion or permanent muscular contraction, when it can generally be sufficiently overcome to show that there is no bony union of the parts.



FIG. 125.—Showing the correct position proposed by period extension of the extremity in a case where irregular flexion existed.

Grating or Crepitation.—Grating felt on movement of the hip joint can be produced by one cause only, the presence of exposed bone. This may be due either to erosion of cartilage allowing the bare head of the femur to gain against bare acetabulum, or to sequestra grating against one another, or to the upper end of the femur rubbing against its own bare and detached head. It is, therefore, where it can be felt, an absolute and pathognomonic indication of the presence of dead or carious bone. But it must be remembered that it can usually only be obtained under an anæsthetic, when free movement without pain can be procured.

Abscess.—The vast majority of cases of hip disease, unless seen in the early stage and adequately treated, go on to suppuration. A certain number of cases get well by the process of removal of the inflamed end of the bone without suppuration—a *cure à la saignée*; but the greater number by far go on to the formation of pus. Yet of this number by no means all develop abscesses which open and discharge externally. Suppuration within the cavity of the joint takes place and even bursts the capsule, and yet, by absorption of the fluid and removal more slowly of the solid elements, the swelling caused by the abscess may disappear and the case recover. Still we are convinced that nearly every case of chronic disease of the hip, if the joint were examined, would at a certain period of its course be found to contain pus or puriform liquid.

When the joint cavity suppurates the pus may take very various routes after it has burst from the joint, but usually it issues at the posterior part, sometimes on the inner, sometimes on the outer side. It may then pass forward beneath the rectus femoris and point at the anterior border of the tensor vaginæ femoris; it may travel down the thigh and point at a lower part of the edge of this muscle; it may gravitate backward and open at the upper or posterior border of the great trochanter, or, farther still, at the lower border of the gluteus maximus; it may reach to the perineum, extend along the adductor tendons, and come to the surface at the inner side of the thigh; or, again, it may pierce the skin just at the inner angle of the fold of the groin between the scrotum or labium and the thigh. It may travel up the sheath of the psoas and point above Psoas's ligament, or, traveling over the beam of the pelvis, may then gravitate downwards and burst into the rectum or the ischio-rectal fossa, or escape through the sciatic notch. We have records of two cases where pus was discharged through the rectum, and

we are inclined to think it is commoner than is supposed, and that the disappearance of abscesses about the joint is sometimes to be thus accounted for. A bad result does not necessarily follow, and some cases are probably glandular abscesses not directly connected with the joint; in other instances local matter has been discharged into the joint.

Abscesses in the neighbourhood of the hip not due to disease of that joint must be carefully distinguished from those which either directly communicate with the joint cavity or result from the breaking down of tubercular matter in the walls of the articulation.

From the cases we have watched we think the conclusion may be drawn that when an abscess points on the front of the limb, above a line drawn through the upper border of the great trochanter, there is disease of the joint, and this is the more certain the higher and the more internal the opening. Abscess pointing between the scrotum or labium and the thigh we always look upon as of serious import, indicating pelvic caries. The peculiar conical projection to be felt on pressure above Poirpatt's ligament, as pointed out by Russell, is rather due, in our opinion, to enlargement of the iliac glands than to periosteal pelvic thickening in the great majority of cases; like thickening to be felt by rectal examination at the sight of the acromialium on the inner wall of the pelvis, it is to be looked upon as a grave sign and one pointing to tracked pelvic disease.

Wasting of Limb.—Muscular wasting of the affected limb is an early and prominent condition in hip disease—so early and so rapid that it is, and with good reason, ascribed to the result of trophic nerve changes rather than to mere disuse. The limb in later stages assumes a peculiar balloon look, the thigh and leg are small, thin, and weak, while the hip itself is rounded, swollen, and distended as compared with the opposite side, and coldness and venous congestion are constantly present, often with oedema of the foot from venous or lymphatic obstruction. The bone, too, undergoes a great amount of atrophy, the denser layer is thinned, and the spaces of the cancellous tissue enlarged, so that the bone becomes diminished both in diameter and strength. Such is the condition which has in several cases led to fracture of the bone in attempts at thrusting the upper extremity out of the wound in the operation of excision, and this is a fact to be remembered in the feeble straightening of the limb.

Arrest of growth under such circumstances is to be expected, and does occur, but to a much less extent than would be imagined, as will be seen in the section on Results of Excision.

Position of Region of Hip.—Two points are always described in connection with disease of the hip as being characteristic of it—loss of the fold of the groin, and flattening and widening of the buttock with lowering and partial obliteration of its fold. These conditions are worth noting, although they are not always present, nor always characteristic of hip disease when they are present. The fold of the groin is most completely obliterated when the limb is abducted and rotated out, especially if there is also swelling of the front of the joint or glandular enlargement. On the other hand, the fold is exaggerated in adduction and rotation inwards; in this position in girls the labium will be compressed, flattened, and partially or entirely hidden.

The *cima antior* is inclined upwards and towards the diseased side, which is simply the appearance produced by lowering of the buttock in the second stage; in the third it of course takes the opposite direction.

Dislocation and Shortening.—The older writers on hip disease spoke of dislocation as one of the common results of the destruction of the *acet.* Probably they were misled, in the absence of actual dislocation, by the shortening, adduction, and inversion of the limb which occur in the third stage.

As a matter of fact it is probable that without injury true dislocation of the head of the femur out of the acetabulum very rarely occurs. Several conditions may exist and give rise to the appearance of dislocation, the most common being distraction of the head of the femur—the fractured



FIG. 148.—Shows the position assumed in the second stage of hip-disease. Pelvis, antior, from, and the leg more apparent lengthening leg. (English Med. Gazette.)



FIG. 149.—A third view of fig. 148.

upper end of the bone is then drawn upwards by the muscles attached to the trochanters, so that the upper border of the great trochanter lies above Nelaton's line; here, as the head of the bone no longer exists, true dislocation can hardly be said to have occurred. Occasionally, however, true dislocation of the head of the femur into the dorsum does occur—we have met with several instances of it.

Apparent lengthening of the limb is due to a lowering and throwing forward of the pelvis on the affected side; apparent shortening, on the other hand, to the pelvis being raised and thrown behind the sound side. Or, to take the same fact in another way, the apparently lengthened limb is *flexed* and *abducted*, the apparently shortened limb is *flexed* and *adducted*, the

two conditions being usually, but not always, associated with rotation outward and inward respectively.

Taking the usual classification of the course of the disease into three stages, the position assumed successively by the limb will be—in the first stage, flexion to a variable degree, with or without slight abduction, and possibly rotation outward; in the second stage, flexion, usually well marked, with abduction usually, and rotation outward, producing apparent lengthening—sometimes, however, there is adduction, and sometimes mere flexion, with no rotation, or with rotation inward; in the third stage there is always flexion, and most commonly adduction and rotation inward, with apparent or real shortening, but there may be abduction and rotation outward. This position, though a valuable, is not an absolute guide, and requires to be checked by the other symptoms present.

Diagnosis.—The diagnosis of disease of the hip is as difficult in some cases as it is easy in others. In well-marked cases where the disease is advanced it usually is quite readily diagnosed, while, on the other hand, few diseases are so closely simulated by a large number of other affections as disease of the hip, and the variety of symptoms that it presents is in itself a fruitful source of mistake. It will, perhaps, most conduce to a clear understanding of the subject if we first tabulate the diseases for which hip disease is most likely to be mistaken.

1. Acute rheumatism.
2. Dermatitis of the groin or one of the gluteal regions.
3. Ostitis or periostitis of the great trochanter.
4. Periostitis of the upper end of the femur.
5. Sacro-diac disease.
6. Psoas abscess.
7. Iliac abscess.
8. Gluteal abscess, traumatic or spinal.
9. Abscess connected with disease of the pelvis.
10. Psoas abscess, suppuration around the sigmoid flexure of the colon, pelvic glandular abscess, or chronic adenitis, or possibly renal disease.
11. Superficial abscess, glandular or other, and deep abscess around the joint.
12. Infantile paralysis.
13. Syphilitic synovitis or teloditis.
14. Hysteria.
15. 'Congenital dislocation' of the hip, or other congenital conditions.
16. Rickets.
17. Disease of the knee.

Of these diseases only a few of the most important need be selected here. Inflammation of the gluteal bursa, of which that between the gluteus maximus and the great trochanter is the most commonly affected, may simulate hip disease. In this case a large gluteal abscess may be mistaken for abscess connected with the joint, or if the abscess has burst the long track left may lead upwards, and be indistinguishable from one communicating with the joint; the absence of shortening, of adduction, or of gaining on movement of the joint, which will also move freely through a certain range, absence of pain on jarring or pressure, and of fullness in front of and behind the joint, are the diagnostic points.

Disease of the great trochanter is more difficult to distinguish, and it must be remembered that inflammation may extend from the shaft to the joint; but, although in trochanteric disease sinuses may exist at the same position as those in which they are found in trochanteric cases, the smoothness and freedom from gaiting, as well as the wide range of mobility of the joint, will serve to distinguish between the two; other abscesses in the neighbourhood of the joint are recognised by their history, which is usually too short for chronic hip disease, and not acute enough or sufficiently severe for acute joint inflammation. They are also recognisable by the freedom and smoothness of the movements of the joint through a certain range, even though that range may be a limited one. Absence of pain and tenderness in some part of the joint circumference will be contributory evidence.

Infantile paralysis simulates hip disease in the lameness to which it gives rise, but is distinguished from it by the absence of pain and swelling, and especially by *freedom of mobility*, and by an *absence* of swelling and coldness of the limb disproportionate to the other symptoms, as well as by the history of the disease; it is, however, worth noting that in the 'British Medical Journal' for 1877 Mr. Savory records a case of acute hip disease in a leg affected by infantile paralysis.

Syphilitic disease is distinguished by other evidences of syphilis, by the slight tendency there is to suppuration, and by its amenability to mercurial or iodide treatment. We have, however, seen chronic hip disease in a congenitally syphilitic child.

Sacro-iliac disease and psoas abscess may both simulate hip disease as regards the position in which they give rise to pain, and as to flexion of the joint; it is, however, only necessary to examine the spine and sacro-iliac articulations to find in most cases symptoms incompatible with disease of the hip alone, while in simple psoitis flexion and inward rotation are free.

It must be remembered, at the same time, that the abscess within the psoas sheath, resulting from either of these diseases, may open into the hip joint, and so a secondary hip disease may be developed. It is not, we believe, very rare for psoas abscess to do so; and, although we have only had one opportunity of verifying the fact *post mortem*, we have in several instances believed such to be the case. Spinal caries and hip disease may, of course, coexist independently of each other, and this is not rare. It is sometimes impossible to be sure that disease of the hip does not exist where an iliac or psoas abscess has burrowed down and surrounded the hip joint on all sides; the symptoms are then often identical, and only the discovery of the spinal or iliac disease can clear up the case. In other instances free mobility of the joint through a certain range in all directions excludes hip disease. Rectal examination enables us to distinguish between hip disease and spinal gluteal abscess, since in the latter the abscess can be felt to extend upwards over the brim of the pelvis.

Abscess connected with the cæcum, or sigmoid flexure, is not uncommonly mistaken for hip disease. Such cases closely resemble iliac abscesses from other causes, with the addition of symptoms indicating connection with or proximity to the large bowel.¹

¹ Pub. paper: 'On some Forms of Abscess occurring in Children,' by G. A. Wright, in *Arch. of Pediatrics*, 1884; also *Lancet*, 1885.

Congenital atrophy of the femur is not likely to be mistaken for recent disease, but may, perhaps, be a result of intra-arterial affection of the joint.

One of the commonest sources of error is enlargement of the iliac or of the inguinal glands; pain, lameness, flexion and some rigidity of the joint are found; on examination by deep pressure above Poupart's ligament the enlarged glands may be felt, and palpation is painful; careful search, however, will show rigidity only in extension or slightly in abduction as well, while flexion, adduction, and rotation are free; there is no trochanteric thickening and no evidence of effusion into the joint. It must be remembered that the glandular enlargement may be due to hip disease itself.

It is always well to use the 'method of exclusion' in doubtful cases, and to bear in mind that there is no one symptom pathognomonic of hip disease, but that, as in other medical conditions, several factors have to be taken into account in forming a diagnosis. *Free, smooth, painless mobility is perhaps the most satisfactory evidence of the absence of hip disease.*

To sum up the diagnostic points of hip disease. A patient who is a child, who walks lame, especially after a little exercise, who has thickening of the trochanter, some tenderness on pressure over the hip joint, and pain together with slight flexion and some immobility of the joint, without evidence of spinal or sacro-iliac disease or pain in any part higher than the hip, and in whom pain is increased by abduction or rotation inwards, has got disease of the hip. We would here lay stress upon the fact that there is not the smallest necessity for hurting a child in an examination for hip disease. It is true that pressure upon the trochanter or heel, what is expressively called by American surgeons 'crowding the joint surfaces together' gives rise to pain in disease of the joint, but it is neither a necessary nor a pathognomonic sign. Night starting is a valuable, but not a constant nor always trustworthy, symptom. Later in the disease the problem is usually easily solved, but not always, for, as indicated above, disease of the trochanter or abscess around the joint, as well as bursitis, may simulate hip disease very closely; in such cases the position and swelling of hip disease, as well as its rigidity, are very closely simulated, and we must rely on other points. Such conditions can, however, only be mistaken for the later stages of the disease, in which there will be shortening of the limb, rising of the trochanter, and probably grating in the joint if examination is made under chloroform. It is only occasionally that we see a child in quite the first stage before the mischief has reached the surface of the bone; in such case pain, lameness, slight flexion, and slight rigidity are the principal signs. Usually the patient is brought in the early second stage, when trochanteric thickening is found.

Believing, as we do, that chronic hip disease in children begins invariably, nearly so, as an osteomyelitis, we cannot follow Barwell's distinctions in the diagnosis of this condition from synovitis. We do, however, think that acute synovitis can be distinguished from the early stages of true hip disease by the greater pain on movement of the joint, with absence of trochanteric thickening, and under chloroform free and perfect mobility in the former; there may be also swelling in front of the joint, but this depends upon the amount of the effusion. In simple traumatic synovitis the mischief immediately follows the injury, while in the bone lesion there is usually an interval of two or

three weeks, or even months, between the accident and the onset of symptoms: thus the child falls, cries for a few minutes, but is then well again, and in a month's time begins to limp. This evidence of the history is most important. Careful inquiry should always be made in every case for any previous trouble about the hip, since the acute symptoms may be grafted upon old latent disease.

Acute osteomyelitis is readily diagnosed; great constitutional disturbance, fever and prostration, great pain, according to agency on the least movement, *deformity of the limb*, rapid and extensive swelling, with venous turgidity, make the diagnosis easy.

Mr. Howard Marsh, in his valuable paper in the 'British Medical Journal' for 1877, gives us most useful information on the diagnosis of hip disease. Thus, he points out that, though flexion may be free in some cases, the flexed limb is carried into abduction, and *not* brought up towards the abdomen; again, flexion may be limited in cases of gluteal, or even in cases of psoas abscess, but in hip disease both are limited in their *more* extreme degrees, even if free in part of the range of mobility. His caution is in the dangers of frightening the muscles and spasm is also well worth remembering. In examining children it is always wise to manipulate the *second* limb first, as this gives the child confidence that he is not going to be hurt, and he is less likely to voluntarily hold the joint stiff. Rectal examination for thickening of the inner wall of the acetabulum we have occasionally found of value in doubtful cases, and it certainly should be employed if there is any suspicion of primary acetabular disease; under such circumstances it may be the only way to clear up the doubt. An excellent account of it is given in Djourdan's work, '*De la Coxalgie Coxipsoilienne*.'

In examining a child for suspected hip disease in an early stage the course of procedure should be as follows. First, the child's confidence should be gained, so that it will not be afraid; next, all clothing should be removed and a blanket wrapped round the patient, who should be allowed to walk on a flat, hard couch or table covered with a rug. The position of the limb and the child's gait should be carefully watched. Then, with the child lying straight and flat upon its back, any abduction of the limb should be looked for, an imaginary test line passing downwards from the middle of the sternum through the umbilicus and pubes being taken as the guide. The length of the two limbs, taking into account the pelvic tilt, is now to be compared. The next point is to notice whether the affected limb is put down flat upon the table—in other words whether the thigh and knee are fixed or the back arched (*jordosis*)—also whether there is any wasting of the limb. The surgeon should then take the *sound* limb gently in the hand and lift flex it, looking for any movement of the pelvis; as soon as the full degree of flexion has been ascertained the affected limb should be very gently raised and its range of mobility compared with that of the sound side, a finger being kept on the anterior superior spine of the ilium to feel for any tilting of the pelvis. Should there be any *jordosis* due to fixed flexion of the hip, this will disappear as the limb is raised and be increased by extending the leg. The finger, or better the thumb, should then be gently pressed into each iliac fossa to feel for swelling there, due to enlarged glands or the presence of an abscess; *induratio* below Poirpau's ligament should also be

looked for. If no restriction of movement has been found, abduction, adduction, and rotation should be tested and the two sides compared.

The child should next turn over and lie on its face—it is generally better to allow it to turn in its own way; the shape of the buttock, the thickness of the trochanters, the gluteal fold, and rima naturae are now inspected and the range of extension further investigated. The spine and sacro-iliac joints should be examined at this stage, swelling of the knee joint and thickening of the shaft of the femur having been previously searched for. If there is still a doubt, a finger should be passed into the rectum, and the inner wall of the pelvis examined for thickening, or abscess, or enlarged glands: for this proceeding it is often necessary to give an anæsthetic. Where disease begins in the acetabulum, but has not yet reached the cavity of the joint, pain and slight lameness may be the only obvious symptoms. Mobility of the joint may be almost perfect. In such cases the presence of thickening felt per rectum as well as by deep pressure in the iliac fossa, is all-important as a means of diagnosis.

No one symptom alone is sufficient for a diagnosis in early stages, but limitation of movement to some extent, and trochanteric thickening, are perhaps the two most valuable signs of joint disease.

We would here deprecate the use of any of the means of diagnosis which necessarily give pain to the patient. The presence of disease is recognizable by the painless mode of examination in all cases where it can be made out at all. In all cases examination for hip disease should be made with the child completely stripped, and lying on a *glad-stone* couch or table.

Prognosis.—As regards the prognosis and the results of collections of the hip joint when treated by means other than operation, it is necessary to distinguish clearly between the two named conditions of acute synovitis and osteomyelitis, acute or chronic: the former recovers perfectly with freely movable joints under proper treatment, and shows no after effects, though the treatment required is usually longer than that for other joints. On the other hand, cases of true hip disease, unless *effectually treated in the early stage*, very rarely recover without entire destruction of the upper epiphysis of the femur, usually accompanied by abscess, and always result in shortening with more or less deformity, and a very large majority die before reaching adult life.

Even when tuberculous disease of the hip seems to have subsided, relapses are exceedingly common after some slight injury or intercurrent illness. It is important, however, to distinguish between relapses due to a fresh lighting up of disease and the presence of an abscess the result of irritation by some quiescent local product of former inflammation—the residual abscess of Paget.

As to the usefulness of the limb after recovery from hip disease without operation, more or less shortening is to be expected in all cases, either as a result of malposition, retraction of the femur upon the osseum ili, actual destruction of bone, or arrest of growth of the femur: the last is the least important factor, since increase of length in the femur takes place almost entirely at the lower end, and what shortening there is is due rather to general arrest of growth of the limb than to destruction of the upper growing line.

In private practice, where hip disease is seen early and treated more

effectually than it can be in hospital practice, the prospect of recovery is much better, though even here a perfect result is rare; it will, however, be obtained under exceptionally favourable conditions. A miserable joint may be obtained where the disease comes under treatment in its early stage, or even after destruction of the joint there may be a certain amount of *ossification*, though this is less frequent than it is after excision.

In fatal cases of hip disease death is generally due to tuberculosis or exhaustion, with hectic or hectic disease; sometimes an intercurrent erysipelas proves fatal. Hence it is seen the prognosis depends very largely upon whether early and efficient treatment, of which that by Thomas's splint is undoubtedly the best, can be obtained. The cases least likely to do well without operation are those in which there is a great amount of thickening, and those in which, in spite of fixation, pain continues, while under any circumstances the prognosis is bad if there is extensive pelvic caries (not necrosis).

Treatment.—First, the ideal treatment consists in seeing the case early, keeping the child in bed until by simple extension on a Bryant's splint the limb is straightened; then a Thomas's splint should be applied, and the child allowed to get up and about, out of doors, by the outside. Good food, cod-liver oil and iron, with occasional administrations of rhubarb and soda if any dyspepsia troubles appears, comprise the rest of the management. Two years should be the time given for rigid treatment; after this the



FIG. 141.—Bryant's Splint. We have had shifting pieces made to fit up the femoral head when required; that is seen in this figure.

splint may be gradually laid aside, and the child allowed to go about with a patten and crutches for a few weeks; if still there is no sign of disease, walking upon the affected limb may be gradually permitted. During the time of treatment the greatest care must be taken not to allow the foot of the affected side to touch the ground, and to avoid all falls or strains of the joint.

American surgeons use to a great extent 'traction splints' of various forms, in which, while the patient gets about more or less, extension is kept up.¹ The weak point in most of these appliances is that the joint is not fixed.

In hospital practice the nearest approach to the above lines of treatment should of course be carried out, but if there is *progressive disease*, and the management is unsatisfactory, excision should be performed at the first sign of external abscess, or before if the symptoms are acute. In either case the presence of progressive disease in spite of treatment, with an abscess other than a residual one, or sinuses, or great thickening, indicates immediate excision. It assumes exit with receding disease, diminishing discharges, and

¹ Or the limb may be straightened by means of the Thomas's splint.

² For a good recent account of these splints we must refer to Dr. Loom's work on *Disease of the Hip*, 1902.

gathering in of cicatrices, or if with an abscess the mischief is quite quiescent or receding, non-operative treatment should be adapted for a time, if it can be thoroughly carried out; if not, or if no progress is made in a few weeks, the diseased part should be removed.

In applying extension by weight it should be made an invariable rule to make traction from the condyles of the femur, and not from below the knee. A case is on record in which prolonged extension applied below the knee resulted in separation of the upper epiphysis of the tibia. It is also objectionable in that it throws strain upon the knee joint, and is more apt to slip off. The strapping should always, if possible, be applied for some hours before the weight is attached, in order that the plaster may get set, and not be dragged off by the weight. The strapping (of which Leslie's woven bandage is the best) should be kept from the skin by a strip of lint or flannel bandage, or part of a stocking, to protect the sharp edge of the tibia and the prominences of the joint from pressure (fig. 141).



FIG. 141.—Shows extension by a weight applied above the knee, with a long splint on the ground side. See the simple plan of keeping the child from sitting up by means of the board running behind the shoulders and fastened to the side of the bed. The shoulders are fastened to this board, and the arms are left free below the elbow. The feet on which the child lies is immovable and set.

We have found that too great extension may be a cause of painful spasm, and it is well to bear this in mind, that too great extending force and too little are alike inefficient. In cases where treatment without operation is carried out, as for instance where adhesions, the result of old inflammation, exist, or muscular contracture has taken place, the deformity may be remedied in many instances by the ordinary extension apparatus, by a weight, or by Bryant's splint. In other cases, where simple extension is inefficient, or too tedious, it may be necessary to forcibly straighten the limb under chloroform, and then fix it by splints in its new position. The advisability of forcible straightening is a somewhat disputed point and is not in all cases free from risk, not only of laceration of important structures, but of setting up fresh inflammation in the joint or what remains of it.

Mr. Howard Marsh,¹ and in 1876 Sir Benjamin Brodie, advised that the extension should be made in the axis of the misplaced limb, and that

¹ *Brit. Med. Jour.* July 1875.

the direction should be altered as the limb regains its normal position. We do not think this a matter of great importance. If it is desired to carry out this plan, probably Hodgson's splint for fracture of the thigh would be the most efficient apparatus.

It is sometimes a matter of difficulty to remedy the malposition of the limb in cases of fixation in combined flexion and abduction or adduction. Here, where possible, gradual reduction by a Bryant's splint is the best treatment (fig. 140); failing this—and it cannot be always used—a long splint on one side, with a weight to the mal-placed side, should be tried (fig. 141);



FIG. 142.—Thomas's Hip Splint, prepared for a case with no deformity.

FIG. 141.—Thomas's Hip Splint, applied. "Slightly altered from the Thomas's with to the 'Hip, Knee and Heel'."

and, failing this, careful straightening under chloroform. Where there is much abduction Volkmann applies a weight to each leg, the heavier one being attached to the sound side. (A. H. Tubby.) These methods are, we think, better than remedying the deformity by weights applied laterally. In some acute cases, where the deformity is mainly due to spasm, gradual extension is best, but by some means the limb must be got as quickly as possible into good position.

Thomas's apparatus is a very valuable appliance, and is undoubtedly the best splint we have for patients able to bear up (figs. 142 and 143). The splint requires careful attention to detail, both in fitting it and in management; it is of use, first, in the early stages of disease, where it is possible to give the child the chance of long-continued and perfect rest, with general hygienic measures; and, secondly, after excision, to keep the limb quiet for a time

and the parts are sufficiently consolidated to allow of movement being begun. We have habitually used it for many years.

The question of when to excise a hip joint is not doubt a difficult one, but the conclusion we have come to is this. Treatment, short of excision, when no suppuration occurs, is, if the disease is progressing, useful only as a palliative. Our opinion, bearing in mind Mr. Holmes's valuable remarks on the usual circumstances of these patients, is that where there is an abscess outside the joint, or, without this, great trochanteric thickening, or such pain that does not yield to treatment by rest, excision ought to be performed. In private practice cases are usually seen in the first or early second stage, and it is possible to ensure that the Thomas's splint shall be kept on and no stress thrown upon the joint; hence recovery without operation is the rule. While fully aware that abscesses disappear and tuberculous lesions cicatrise under favourable circumstances, we think that in the case of the hip delay is unwise among the hospital class, with whom it is as yet impossible to deal on the same lines as with the well-to-do. In almost every instance we have found much more extensive disease than might be expected from the external evidence, unless the pathology of the affection is borne in mind, and we believe that, once this chronic osteomyelitis is fully established, nothing short of excision can, in the majority of hospital cases, prevent the ultimate progress of the disease to abscess, and too often to gradual exhaustion of the patient by pain and discharge. Nature, of course, in many cases will, unaided, get rid of the dead bone by slow and tedious processes, but the number of children who can survive the process of elimination is very small, while the mortality after early excision is not great, and the failures are mainly in those instances where the operation has been put off till too late. Where actual necrosis, or caries of the head of the femur, with destruction of bone and cartilage, and often sequestra of varying size in the acetabulum, or at least caries of it, is known to exist, we think few advocates of non-operative treatment will be found. It is then, as Mr. Bryant points out, to be looked upon rather as an ordinary operation for necrosed bone than anything more formidable; and that this is the state of the joint even in cases often spoken of as those of early disease is the fact upon which we should like to lay stress.

As soon, then, as there is any evidence of external abscess, excision should certainly be performed, and still better results will, we believe, be obtained by operating even before the pus has escaped from the articulation. It is necessary of course to distinguish sharply between abscess the result of progressive disease and residual abscess; it is in the former that immediate excision is called for. Where the disease is quiescent, abscesses may well be dealt with by the method already described, of thorough clearing out and drainage after injection of iodoforn emulsion. We are not disposed to think that mere injection of iodoforn into tubercular joints without removal of the original focus of disease will be successful to any great extent. It is undoubtedly useful in some cases to deal with the abscess first, and, when that has healed, to remove the diseased bone by a second operation under more favourable conditions. The operation of excision is discredited because it is put off until disease is so far advanced that no mode of treatment can have more than a small proportion of good results; while timely excision

cure short the disease, saves pain, lessens the time of treatment, and gives a better limb.

Mode of Excision.—Various incisions for removal of the upper end of the femur have been advocated. Of these the incision over the middle of the trochanter and slightly curve forward is the one we usually adopt. We see no advantage in most of the others over the one extending downwards for about three inches, more or less according to age and the extent of the disease, along the middle of the trochanter. Where however it is proposed to remove a large part of the pelvic wall, a flap operation is desirable, and we have recently frequently used it; the flap incision has the advantage of freely exposing the diseased area and allowing thorough clearing of the soft parts, and by chiselling off and turning up the trochanter with its muscles attached the power to move the limb subsequently is likely to be gained.

Next, if a flap is not made, the soft parts should be divided vertically above the trochanter and the capsule opened freely, if this has not been done by the first incision. The joint should then be explored with the finger.

The next step is to separate the soft tissues from the bone on the inner side, stripping back the periosteum as far as it exists as such. The finger should then be used to pass round the bone and feel that the upper end is free; next, still using the finger as a guard at the inner side of the bone, the finger should be seen through just below the trochanteric margin with a keyhole or finger saw. Some part of the trochanteric epiphysis is usually left behind. The upper extremity of the bone is then readily picked out with the finger if respiratory. The arthrodesis should be then examined and any sequestra removed. If there is a large carious surface it may be gouged or scraped with a Volkman's spoon or left alone. It is well to remove any rough or semi-necrosed bone, but we doubt the possibility of being able to remove all the disease without greatly adding to the severity of the operation where there is extensive inflammation without necrosis, nor is such treatment desirable.

The upper end of the femur should be examined to see if the whole disease has been removed; if not, a further section should be made, and this may be carried a considerable distance down the shaft; six inches have been removed with a good result, and but little shortening, by an American surgeon.

Here it is well to point out the danger of the practice of thrusting the head of the femur forcibly out of the wound before sawing it through, instead of dividing it *in situ*. Several cases of fracture of the shaft of the atrophied fatty bone have occurred. An additional objection to this practice is the case with which the periosteum may be thus stripped off the inner aspect of the shaft, and so necrosis may occur.

The operation is much more easily and safely done in the way described, and involves less violence to and less division of the soft parts. The finger is quite as good a guide as the eye to the condition of the bone.

Usually no vessels require ligatures, though there is sometimes free oozing of blood. If the wound can be made aseptic, it should be carefully cleared and closed by sutures after injection of iodoforn emulsion; if the case is one with old-standing sinuses, we prefer to leave it quite open, and in

the case a large drainage tube should be passed deep into the cavity of the joint. Any sinuses or abscess cavities should then be thoroughly scraped out and well cleaned before applying the dressing. It will often be found that a distinct membranous layer of lymph lines the cavity of the articulation, but there is rarely anything like the thickness of granulation tissue as often seen in the knee and other joints. It is well to remove any masses of polyp granulations should they exist, but anything like the elaborate dissection required in erosion of the knee is impracticable.

There is not, we think, any great advantage in retaining only the head of the bone and leaving the trochanter. A section through the neck will often leave unhealthy bone behind. In many cases the head of the femur is so far destroyed that it would be impossible to do less than take away the trochanter, while the trochanter if left in cases that require drainage tends to block up the orifice of the wound and prevents the free escape of discharge and debris of bone, and thus interferes with one of the main objects of the operation. The Clinical Society's Committee advised that the trochanter should be left unless diseased, or unless there is extensive pelvic disease, and where the flap operation is employed it must be left.

Where intrapelvic abscess exists the acetabulum should be perforated. Examination per rectum enables the diagnosis to be made if this condition is suspected.

As regards the use of antiseptics, they should, of course, be used in all cases. The most convenient form of dressing afterwards is a thick pad of wool-wool wadding, over a thin layer of wet gauze. Iodoform should be freely dusted into the wound before applying the dressings, and iodoform emulsion injected into the recesses of the wound after thoroughly cleaning it out.

Messrs. Barker and Pollard, in December 1888, brought before the Medical and Surgical Society of London a new method of managing the operation of excision of the hip. The method consists in clearing away all disease of the soft parts by scraping or excision; scraping out abscess cavities, and by means of thorough and careful asepsis getting the wound clean. The novelty is in their mode of carefully drying out the wound and closing it entirely after removal of all tuberculous material as far as possible, so that primary union is obtained. Messrs. Barker and Pollard showed cases in which this result had been obtained, and we have since then followed their plan in its main features with success. There is no doubt this is a valuable improvement, but it is applicable to cases of early excision chiefly, or only, and experience shows that even so there is danger of relapse (p. 661). For further details we must refer to the '*Medico-Chir. Transactions*,' 1888; but we may repeat here Mr. Pollard's abstract of the essentials of the method—

1. The whole of the tubercular growth must be removed.
2. Perfect asepsis must be assumed.
3. Bleeding must be checked and the wound made as dry as possible.
4. Healing must be checked by the even, elastic support of a wool-dressing and a moderately tight bandage.
5. Absolute rest of the part must be maintained during the process of healing.

Following Mr. Howse, we prefer to have the extension put on before the

operation, so that the weight, or, better, Bryant's splint, can be applied at once before the patient is put to bed. The shock of the operation is often somewhat severe, but usually soon passes off under the use of opium and stimulants. Rarely, however, much more severe and prolonged shock occurs.

The subsequent management of the case requires some special remarks. It is exceedingly difficult to keep the wound aseptic in cases where sinuses have previously existed or where there is widespread suppuration. It is,

however, a great gain if the wound can be kept sweet even for a time, and with present methods (sh25) primary union after excision may be expected in a large proportion of cases. (See Note, p. 663.)

The after-treatment of cases of excision simply consists in dressing and in keeping the limb quiet and in good position. This may be done by various means, of which the best are simple extension by a weight (the weight may usually be reckoned at one pound for each year of the child's age from two to six; six pounds is generally enough up to twelve years of age) after which more may be added, with or without a long splint on the opposite side, and a Bryant's double splint, which has many advantages in securing 'parallelism of the two limbs,' and in ease and comfort with which the patient can be moved. It is an invaluable apparatus, and we now almost invariably use it.

The *sooner* excision cases are got up and about, the better: some cases may leave their beds in three weeks; others, of course, are much longer in getting up, the difference depending mainly upon the state of the disease at the time of operation.

The period of convalescence after excision varies from the time mentioned to two years, while in some cases sinuses may remain open much longer if pelvic disease exists. We keep our patients usually in a Thomas's splint for from at least three to six months after excision; after this the child, if old enough, should get about with a gaiter and crutches, allowing the limb to swing, and only after a year or more should he be allowed to gradually bear weight upon the leg. If, however, excision is done early, the limb is fit for walking *sooner*, sometimes in five or six months. If the affected leg is allowed to touch the ground too soon, it becomes pushed up upon the *divariculi*, and much shortening results. On the other hand, if the limb is fixed too long, it becomes stiff. A very large proportion of cases of excision in the later stages of the disease remain with sinuses, but often these produce no ill result except the trouble of dressing them; a certain number may be got to close by scraping, cauterization, &c.; others are very intractable. In a



Fig. 140.—From a photograph showing a good average result after excision, when the leg has been walked upon, and the stump of the femur is drawn up upon the *divariculi*.

certain number of cases the wound re-opens after having healed; this is undoubtedly common, but is due to over-use, neglect, or violence, and with ordinary care and frequently repeated scrupings with cloths of the wound after excision of tuberculous tracks and edges of skin, the wounds usually again close.

It is interesting and important to note that in measuring the amount of shortening after excision the real shortening—as measured from the upper end of the femur to the malleolus on each side—is often trifling, and sometimes there is none, while the practical shortening as measured from the pelvis to the malleolus is considerable. Though some shortening will necessarily result, any large amount is due to weight being borne upon the limb prematurely. It has already been pointed out that growth in length of the femur takes place almost entirely at its lower epiphyseal line; hence the loss of length or true shortening is only the distance from the line of section to the top of the head, coupled with such arrest of growth as may result from impaired nutrition, this last being, of course, a very inconsistent quantity. Other estimates that during the first four years of life growth takes place about equally at each end of the femur; after that time the lower end grows more rapidly.

The primary objects of the operation of excision of the hip are to save life and relieve pain; the next most important question is that of the usefulness of the limb and of the condition of the 'joint' after the operation. One of two results must occur after excision—either a freely movable limb, or one with varying degrees of stiffness, from some mobility to bony ankylosis. Bony ankylosis after excision is very rare. Close fibrous union, so that but little mobility remains, is very common; movement through from 30° to 40° is perhaps the commonest result, and a smaller number have complete mobility.

It is not possible to estimate in figures the results to be expected from excision; for details we must refer to the monograph mentioned at the beginning of the chapter.

Whether, then, we consider the pathology of the disease, the actual local condition, the relief of pain, the preservation of life, the duration of illness, the condition of the limb and its usefulness, or the dangers of secondary disease, on every ground, in our opinion, excision is the best course under the circumstances already stated.

Evolution.—1. The hip joint in childhood is commonly subject to two affections: (a) simple synovitis; (b) tubercular disease.

2. Simple synovitis is usually traumatic, very rarely suppurative, is amenable to ordinary treatment, and as a rule leaves behind no bad results.

3. Tubercular disease, or common 'hip disease,' affects primarily the upper end of the femur, or occasionally the acetabulum, and produces necrosis or extensive caries.

4. In the early stage of hip disease, before caseation of bone or suppuration has taken place, proper treatment will, in a fair proportion of cases, result in recovery with a nearly perfect limb.

5. As soon as suppuration occurs, it is certain that recovery will not take place without destruction of the upper epiphysis of the femur more or less completely.

6. The process of removal of the diseased bone without operation is so slow, so exhausting, and so uncertain, that it should be reserved for those cases where time and care can be fully devoted to it.

7. Unless absolute rest and treatment for two years can be ensured, excision of the upper end of the femur should be performed as soon as suppuration or other evidence of necrosis is present.

8. A case of hip disease, seen before suppuration has occurred, is best treated by the use of a Thomas's splint with or without previous straightening by extension.

9. Excision of the hip cuts short the disease, relieves pain, and gives a better limb than the average result obtained without operation in cases of equal severity.

10. Excision should be looked upon as an ordinary operation for necrosis, and the operation itself is not necessarily attended by a higher mortality than sequestrectomy elsewhere.

11. Excision in old pelvic disease, or where the health is broken down, or the patient is over fifteen years of age, should be rejected in favour of amputation.

12. The presence of a sinus after operation, unless there is much discharge or evidence of extensive pelvic disease, does not imply failure of the operation.

13. The presence of an abscess after a long period of quiescence (medical abscess), without other evidence of relapse, is not to be looked upon as of serious import.

Amputation.—The question of amputation at the hip joint for disease is one of the highest importance. We must consider not only the unavoidable mortality and crippling caused by the disease, but also the interference with pleasure and education entailed by long confinement to bed. When there is an reasonable prospect of recovery with a useful limb, amputation must not be too hasty set aside.

There is little doubt that, in cases of extensive disease where the femur is necrosed for a long distance and the powers of the patient are inadequate to repair it, in cases where descending osteomyelitis occurs, and in cases where profuse discharge and amyloid disease come on, amputation should be performed.

In cases of more advanced amyloid disease, unless the powers of the child are so enfeebled that the operation will prove fatal by shock, it might also undoubtedly be done.

In another class of cases the question is more difficult. Where there is disease of the pelvis, is amputation contra-indicated if other conditions require it? We should answer yes, if the pelvic disease extends so widely that there is no hope of removing it at all, and the condition is one of caries and not necrosis. Where there is caries limited to the neighbourhood of the acetabulum, where there is necrosis, or where there is reason to think that the disease in the limb is preventing repair in the pelvis, amputation should be performed.

As to the question of saving life, amputation at the hip performed with due precautions as to hæmorrhage and shock, and special care during the first twenty-four hours, is not a very fatal operation in children.

We have amputated in eleven or twelve cases in children. In nearly all cases had been previously performed. All of these recovered well from the operation except one who died of hæmorrhage.

The best plan is the oval incision of Fureux-Jordan; the excision should be infixed, and the line of section brought as far as possible from the arm and vulva.

Neither the various methods of operation nor the best means of controlling bleeding are questions suited for discussion here. Elevating the limb before operation, and digital pressure with the help of an elastic tourniquet in the early stages of the operation, are as efficient means of controlling the hæmorrhage as any; in several cases we have ligatured the femoral or external iliac as a preliminary, and think well of this plan.

If possible, it is, as pointed out by Mr. Slater, well to preserve as much periosteum as possible, and it will be found that after excision the bone usually very readily separates from the periosteal sheath; a longer, firmer, and more or less mobile stump may be thus obtained.

Double Hip Disease is not a very rare condition, and we have more than once had cases in which the second joint has become diseased while the child was lying in bed for the treatment of the first joint. The management of these cases is that of the common condition, except that a double Thomas's splint is of course required. Double excision is occasionally called for, and we have had good results from it; in one case the child remains sound and well, and is able to walk without support.

Scissore-legged Deformity after Hip Disease.—Mr. Lucas, Dr. Tyson of Fellsfoot, and others have recorded cases where, as a result of double hip disease, a peculiar 'scissore-legged or scissure-legged deformity' occurs; both legs are adducted, the one in front of the other, and progression takes place entirely by movement at the knee joint. It is easy to understand the condition by simply walking with the knees crossed over one another. It occurs, according to Mr. Lucas, in cases where disease has taken place first in one joint, resulting in adduction, and then subsequently in the other joint. Other deformities may result from the same condition.

Tubercular Endæmie.—Mention must here be made of instances in which, after some operation upon a local tuberculous lesion, a rapid general tuberculosis is set up and the child speedily dies, often of tubercular meningitis. There can be little doubt that in some, at least, of these cases there has been a direct infection of the system by the entry into the circulation of tubercular emboli from the wound. The only means of avoiding such catastrophes is to take care to remove all tuberculous material as thoroughly as possible and to clear the wound efficiently. Happily such an occurrence is rare, but we have undoubtedly met with instances of it.

NOTE.—Our Senior Resident, Dr. Carruthers, has kindly gone over our records of excisions of the hip from 1885 to 1899 performed by the writer. He reports that 33 operations have been done, of which in 21 instances the wound was united without drainage. Of these 22 healed at once, i.e. by primary union throughout, or with the exception of small superficial abscess; 9 cases failed to unite at once, and 2 of the 22 which united healed again after varying periods. These figures must be taken as approximately only, somewhat 25 wounds may have reopened shortly after discharge, and in one or two cases of the 23 the result is doubtful.

CHAPTER XXIX

SPINAL DISEASE.

Caries of the Spine, Angular Curvature, and Pott's Disease, its terms which, as commonly used, include conditions of very varying severity affecting several different structures. This is so, since the spinal column in each segment provided with several different articulations, and any of these, as well as the bone itself, may become the seat of disease. Thus the mischief may begin at the junction of a vertebral body and intervertebral disc, at the junction of a vertebral body with its apophysis, at the centre of a body, or on its anterior, posterior, or lateral surfaces; or, again, the articular processes, or their joints, the transverse and spinous processes, may any of them be separately diseased. Again, the mode of connection between the skull and atlas, the atlas and axis, and the sacral joints implies necessarily varying conditions from those found in disease of the rest of the column.

Obviously the names given to disease of the spine are not equally applicable to all these affections; disease of a spinous or an articular process does not give rise to angular curvature. It is, however, quite the exception to find in children disease of the spine affecting any part except the bodies and intervertebral discs; we can only call to mind two cases of disease of a spinous process alone, one of which was the following:—

Case.—*Necrosis of the Cervical Spine: Protrusion of the Disk.*—A boy 4 years 3 months admitted July 27, 1884. Six weeks ago a hard lump was noticed at the back of the neck, he having, a fortnight before, fallen on the back of his head; the swelling had gradually increased, but he had had neither pain nor tenderness. On admission he was well nourished; there was a large fluctuating swelling in the middle of the back of the neck; teeth opened unexceptionably, and about 20 lb of healthy pus escaped; the tips of two or three spines were bare; the swelling slipped the next day; the abscess continued to discharge, and he was sent out on August 23 with a suppurant sore and a still enlarged neck. In January 1885, at Our-Patients', he was nearly well—the circumference of the neck was perfect and the thickening nearly gone, but there was still a small sore. Subsequently a sequestrum consisting of the spinous process was removed, and he quite recovered.

We have never verified a case of disease of a joint between the articular processes, and disease of the transverse processes is rare. The atlas-axis and occipito-atlantal joints are also very rarely affected in children in comparison with caries of the bodies.

The ordinary form of caries of the spine affecting the bodies or intervertebral discs or both structures is met with in all parts of the spinal column from the axis to the sacrum. In a hundred cases taken at random from our Our-Patients' papers we found eighteen cases of cervical disease, forty-one cases where the cervico-dorsal, upper, or mid-dorsal regions were involved,

thirty-three instances of lower-dorsal or dorso-lumbar disease, six of lumbar caries, and two of disease of the sacrum. R. W. Parker, as quoted by Eichsen, gives the following figures: Cervical nine, dorsal eighty-two, dorso-lumbar twenty-one, lumbar or lumbo-sacral thirty-seven, out of 149 cases. These figures are of some importance, for, in the first place, no attempt at removal of diseased bone can be made in the dorsal region, and only exceptionally in the cervical part of the spine, while the treatment of the disease by apparatus becomes more troublesome as we ascend from the mid-dorsal region. Pus is more likely to point externally as lumbar or psoas abscess when the lower dorsal or lumbar vertebrae are attacked, though it is not rare for dorsal abscesses to track down the spine. Cervical abscesses point in the pharynx or side of the neck. Lastly, occasionally two foci of disease exist, as in fig. 145.

Pathology.—It is probable that caries of the spine begins nearly always in the body of the vertebra, and not in the intervertebral disc itself; but it is difficult to be sure of the relative frequency of these sites, for the mischief soon spreads beyond the limits of a vertebra in most instances. Eichsen considers the epiphyseal lines, the front of the bodies, and the centre of the bodies to be in this order the most frequent primary seats of disease. Wilks and Mosen apparently incline to the belief that the bones are the primary seat of 'scrofulous' disease in children, while disease beginning in the discs is a separate type of lesion—at all events in some cases the result simply of injury; probably the seat of disease varies. In most cases the lesion is an ordinary tuberculous disease of bone, rarefying totius being found in some parts, while in others caries, necrosis or more extensive necrosis exists. Although a large number of patients, the subject of caries of the spine, never develop external abscesses, it by no means follows that no suppuration takes place; large collections of pus may form beneath the anterior common ligament in the dorsal region without ever discharging, and may, like abscesses elsewhere, dry up and remain as cheesy or calcareous masses. More rarely the abscess may empty itself into the lung or intestine; the latter result we have seen in a case of lumbar caries and in sacral disease, and it is probably more common than is supposed, the pus in the motions being overlooked or put down to enteritis.



Fig. 145.—Caries of the spine, showing two foci of disease.

In other instances cases of the spine, like caries elsewhere, may be thought-out unattended with any pus formation (*cavum siccum*).

There is often a discharge of small sequestra from spinal abscesses, and sometimes far-drawn pieces of dead bone come away or are extracted, but this is not common: as in the well-known instances of the alar process coming away entire through the pharynx.

Pus from a lesion in one part of the spine may track downwards and give rise to a second focus of disease lower down, but sometimes, as in fig. 143, the two foci are quite independent and isolated from each other; in the case from which the figure was taken the lower patch of disease developed first.

In some instances disease may begin as a simple non-tuberculous inflammation, the result of injury as already mentioned: this is not, however, common in children in our experience, since in them the disease usually runs the course of tuberculous lesions generally. Cases of spinal dysgenesis, due to the lesions of congenital syphilis, are also described.

Abscess.—Pus in connection with spinal cases usually burrows along certain definite lines determined by muscular and fascial barriers; thus in the neck, abscesses are either psoas-vertebral, bulging forwards into the pharynx, as in atlanto-axial disease, or point at the side in the posterior triangle, just behind the sterno-mastoid, sometimes on both sides.

In the lower cervical and upper dorsal regions the abscesses, if they exist, rarely point externally, but if they do so either track down the spine and appear as lumbar or psoas abscesses, or perforate an intercostal or intertransverse space and appear in the back. Abscess in upper dorsal cases comparatively rarely points externally. Dorsal and lumbar caries commonly give rise to psoas abscess, the pus getting into the sheath of the muscle at its upper attachment and burrowing down within it, often entirely destroying the muscle itself; it then may either pass outwards into the iliac fossa, beneath the iliac fascia, and form a swelling there (*iliac abscess*), or, travelling on beneath Psoas's ligament, lodge in the thigh on the outer side of the femoral sheath as a psoas abscess. Often, however, though forming a collection in front, the matter does not point there, but, passing on behind the vessels towards the lesser trochanter, appears at the back of the thigh as a gluteal abscess. In other instances the pus finds its way round the edge of the quadratus lumborum and through the transversalis aponeurosis, perhaps in the course of a branch of a lumbar artery, and points in the back (*lumbar abscess*). Again, the pus may gravitate backwards into the pelvis and escape through the sciatic notch, appearing as another form of gluteal abscess. We have seen an abscess bulging on both sciatic foramina, so that fluctuation could be felt across the cavity of the pelvis. Less often the abscess descends over the iliac crest on its outer aspect, or burrows forwards between the layers of the abdominal wall. Once it has reached the thigh, matter may track down it for an indefinite distance.

Deformity.—In most cases caries of the spine sooner or later gives rise to angular deformity (*kyphosis*). This is, of course, due to destruction of the bodies of one or more vertebrae, and consequent collapse of the column; or possibly, to a certain extent, is caused by muscular contraction drawing together the adjacent bodies, the spines being thereby made to project

posteriorly. The amount of deformity in such cases varies from a mere firm persistence of one vertebral spine, only to be recognised by careful observation, to a great prominent 'kink' involving six or eight vertebrae. When the disease is in the dorsal region, the falling together of the vertebral bodies produces a corresponding chest deformity; the ribs are brought close together, the shoulders are raised, and the head looks sunken between them, the antero-posterior diameter of the chest being increased at the expense of the vertical.

In the cervical region the deformity is usually much less marked; sometimes, however, there is a prominent angular curvature, and the head is drooped forwards with the chin upon the sternum; or the head and upper cervical vertebrae are poked forwards with a projection backwards at the root of the neck.

It must be remembered, however, that these deformities occur only in an advanced stage of destruction, and only when the whole breadth of a vertebra is eaten away; thus, disease of one side or the posterior part of a body may exist without any angular deformity, and in some instances the spine is recurved, so that the convexity is forwards instead of backwards; this is most commonly seen in the cervical region: we have, however, seen it in the lumbar vertebrae too. In such cases the bending is never sharply angular, but is due to spasm of the posterior spinal muscles; it can rarely, if ever, be due to destruction of bone, for to produce such result, not only the bodies but the arches of the vertebrae would have to be destroyed: the condition is generally merely an exaggeration of the normal curves.

Since there is a physiological curve with its convexity forwards in the cervical and lumbar regions, a certain amount of destruction of the vertebral bodies has the effect of merely straightening these curves, and it is only when considerable erosion has taken place that a curve with its convexity backwards is produced.

Extensive disease of the posterior parts of the bodies may, of course, exist without any curvature, and in such cases the inflammatory material poured out may produce pressure on the cord or nerves, or inflammation by extension; hence the old saying, 'The less the deformity, the more the paralysis.'¹ Paralysis in such cases is probably hardly ever due to bony pressure, since the spinal canal is not encroached upon; this is only likely to occur where a sequestrum is pushed into the canal.² Lateral curvature sometimes results from destruction of the sides of the bodies and consequent collapse; more often, however, any lateral curvature that does exist is a result of ligamentous and muscular weakness, and as such is a true lateral curvature.

Before there is any permanent deformity from loss of material, certain characteristic attitudes are assumed by the subjects of spinal disease. In cases of the cervical spine the child often supports his head with his hands, to lighten the pressure upon the diseased spot and prevent any sudden jar, and is slow and careful in turning round and stooping. Where the dorsal or lumbar regions are involved, instead of bending the spine to reach any object

¹ It is also a matter of frequent observation that paraplegia and abscess are rarely associated.

² Paraplegia is commoner in cervical and upper dorsal cases than in disease lower down.

upon the floor, the child bends the knees and hips, and so brings down the hands, and at every opportunity assumes the resting position shown in fig. 14b.

It is most important to distinguish angular curvature from lateral curvature and from ricketsy spine. It is only in the very early and very late stages of disease that there is likely to be any doubt whether a case is one of lateral or angular curvature; in ordinary well-marked cases the distinction is clear enough. In some old cases of lateral curvature very sharp



Fig. 14b.—Case of the Spine, showing a ricketsy resting attitude, which should be compared with the ricketsy spine seen in fig. 24.

bends in the spine are much like sigmoid deformity; and again, we have more than once seen cases where there was an early lateral curve and no symptoms pointing to caries, yet in a few months well-defined caries appeared. Careful and repeated observations are, therefore, necessary if there is any possibility of doubt, and it must be remembered that the two affections may co-exist. Ordinarily a diagnosis is readily made by the presence in the one of a lateral curve and of rigidity, and by the fact that the curve in caries is sharp, in lateral curvature gradual, as well as by the presence or absence of the other symptoms of caries mentioned.²

The ricketsy spine is distinguished by its being a general rounded curve, by the absence of rigidity, by the disappearance of the curve when the child is held so that no weight comes upon the spine, by the evidences of rickets elsewhere, and the absence of the characteristics of caries. Caries also is very rare in the first two years

of life, ricketsy spine much more common during that period.

With these exceptions and the possible ones of an old fracture or dislocation, or congenital undue prominence of certain spines, or the development of haire over the spines, the result of friction or pressure, angular deformity may be taken as pathognomonic of caries either present or pre-existing.

Abcess is not by itself a certain indication, since it may be due to many other causes than spinal caries; still, the presence of a lumbar, gluteal, iliac, psoas, post-pharyngeal, or cervical abcess should always lead to a careful examination of the spine. It must be remembered that pelvic, ovarian, glandular, perityphilitic, perigastric, and perinephritic abcesses, empyema, carious ribs, sacro-iliac and hip disease, &c., may give rise to suppuration which may point in positions identical with those in which spinal abcesses may find outlet.

² See also a paper by Lawt of New York, 1890.

Rigidity is a most important sign of spinal disease; important all the more because it is an early one; the stiffness is due to spasm of the spinal muscles, just as in disease of any other joint. Rigidity is best tested by stopping the child and putting some object upon the floor for him to pick up; by watching carefully it will be seen whether the whole spine bends as in health, or whether it is held stiff and immovable in any part. Healthy children freely bend their spines, but in order to fully test the mobility of the column the child should be told to keep its knees straight. Absence of flexibility is, taken alone, the most valuable sign of caries except deformity.

In the cervical region, muscular spasm may give rise to wryneck, inability to nod or to turn the head round, according to the part involved.

Besides contraction of the posterior spinal muscles, there may be rigidity of the iliopsoas, causing flexion of, and inability to straighten, one or both legs; this usually means that a psoas abscess is beginning to form, and the muscles are rigid in consequence of irritation, or kept voluntarily contracted to prevent pressure upon the abscess. Local rigidity of the lumbar muscles or of certain of the posterior spinal muscles will sometimes be found; thus the erector spine may be seen tightly contracted and standing out prominently just above the sacrum.

The test of bending the body backwards is more applicable to adults than to children, in whom it is difficult to estimate amounts of pain; it should, however, always be employed.

Muscular wasting occurs in spinal as in other joint diseases, but is rarely well marked, except when the disease is far advanced, and hence is not of great value alone as a symptom.

Dysphagia may result from pressure by an abscess upon the pharynx or œsophagus, or dyspnoea from pressure upon the trachea or lungs or upon the recurrent laryngeal nerves in disease lower down; it too, possibly, extensive abscess in the chest may give rise to physical signs, dulness, &c. This is, however, more likely to be due to enlarged mediastinal glands.

Large abdominal abscesses may produce pressure effects upon vessels and viscera, but these are rare results. Abdominal distension from distalness may be due either to pressure upon nerves or to failure of the digestive powers in later stages, or to coincident tubercular disease of the intestines, mesenteric glands, &c.

The *subjective symptoms* of spinal caries are pain and loss of sensation. Pain may be acute or nothing more than a feeling of tenderness or aching; it is usually an early and prominent symptom; it may, however, be entirely absent, just as in some instances of chronic joint disease elsewhere. Usually there is pain over the affected spot, increased by pressure or jarring of the spine, such as may occur in jumping, or suddenly stopping down from a height; in caries of the cervical spine, pressure upon the top of the head often causes suffering, and in any part of the column flexion or rotation movements may be painful.

Further, there is usually pain in the course of the nerves passing on from the diseased area; thus, in dorsal caries there is pain at the sternum or in the side; in dorsi-lumbar disease there is abdominal pain ('girdle pain'; so called 'dry belly-ache'). Pains in the limbs, shooting down the legs over the distribution of the sacral and lumbar plexuses, and similarly in

the arm, may be met with. Any obscure pain should always be carefully traced to its source by searching along the whole course of the affected nerve up to its origin. Thus, pain in the back of the head, so-called 'headache,' may be due to pressure upon the occipital nerves, and so on.¹

The anæsthesia and paresthesia due to spinal caries are either the result of pressure upon the thoca or nerves or of inflammation spreading from the bone to the meninges or cord, and will be found described in Chapter XXIII.

Pain is the sign it sometimes increased by the application of warmth, e.g. a hot sponge applied over the diseased part, but the symptom is no constant one of any great value. In some instances we have found herpes zoster occurring in connection with caries of the spine, and it is worth while to examine the spine in cases of shingles, since the eruption may be a result of lesions starting in the spinal column.

The conditions most likely to be confounded with spinal disease are, in the neck, spasms or stiff neck from cold, reflex irritation, &c., glandular inflammation, and cervical cellulitis. The 'vertebra prominens' should be remembered, and the ease with which the cervical transverse processes can be felt; there is often a deceptive feeling of thickening about the cervical vertebra which is apt to mislead unless comparison is made with a healthy neck. In cancer thickening will be felt. In glandular abscess the glands themselves can usually be felt to be enlarged, and generally the pain is most marked or only exists on one side, whereas in cancer there is usually tenderness on pressure on both sides. This, with the other symptoms already mentioned, will serve to distinguish between the two conditions. Paravertebral abscess, though often due to spinal disease, may be the result of several other lesions; (1896 p. 73).

Caries of the dorsal and lumbar spine has already had its distinguishing features pointed out; it is only necessary to add that in all cases search should be made for evidence of abscess deep in the abdomen, since large collections of matter sometimes form very insidiously.

Complications.—In addition to the troubles arising directly from the spinal lesions other complications may arise; thus the vertebral disease may be only a part of a general tuberculosis in which viscera or bones and joints other than the spine may be involved. Sometimes a psoas abscess is tracking down gives rise to disease of the sacro-iliac or hip joint (vide Hip Disease). As a result of pressure upon or inflammation of the spinal cord and its membranes cystitis or paralysis of the bladder may result; bedsores may form both as a consequence of pressure and from the nerve lesions. Exhaustion, hectic, haemorrhagic disease, and general tuberculosis are the most common causes of death, though it must not be forgotten that sudden death may occur from displacement, the result of softened ligaments, in the upper cervical spine, or from bursting of an abscess into the air passages, or ulceration into a large vessel. In other instances pyrexia of some intercurrent disease cuts life short.

Paraplegia may occur in the course of spinal disease as a result of pressure from inflammatory exudation poured out into the spinal canal, from effusion pressing upon the nerve roots, an occurrence met with in the cervical

¹ For illustrations of these peripheral pains the reader is referred to Mr. Hilton's admirable book, *Rest and Pain*, edited by Mr. Jacobson.

region ('cervical paraplegia' of Gill), from necrosis and projection of a sequestrum into the canal, or rarely from the angular bending of the spinal column. Paraplegia occurs most frequently in cases of caries of some part above the lower dorsal spine, rarely in lumbar disease. The degree of paralysis varies from mere weakness with paresthesia to complete paralysis of the lower limbs, the bladder, the rectum; or in rare cases the paraplegia may be complete below the lower cervical region. There are loss of power, diminished sensibility, exaggeration of the reflexes, more or less contraction of the limbs, and, in cases where the cervical or lumbar enlargement of the cord is involved, actual muscular degeneration. Pain may or may not be present. For details *vide* Chapter on NERVOUS DISEASES; PARAPLEGIA, p. 334.

Mode of Repair.—Repair in the spine takes place just as in other joints: the carious or necrotic process ceases, and the tissue injured beyond recovery is either thrown off and comes away in the discharge, or is encased and remains quiescent, giving rise to no more irritation. The granulation tissue either develops into fibrous tissue or ossifies, and the adjacent bone surfaces are welded together; in addition to this bony spurs and bursae are developed around the diseased spot and further strengthen it.

It is possible in very early stages for the inflammation to subside, and the parts to return to their original healthy condition; but once there is loss of substance the curvature is never lost, though the spine may appear straighter from development of compensatory curves, or from straightening out of other more transitory yieldings due to muscular and ligamentous weakness.

Treatment.—Disease of the spine requires treatment on exactly the same principles as disease of other joints, viz. rest and general hygienic measures, with such management of abscesses as each case may demand.

The general treatment need not be specified here further than to say that nutritious and careful diet, iron, and cod-liver oil, together with good air—usually if possible—are the desiderata. The difficulties arise in obtaining rest and in the treatment of abscesses. Rest implies absolute fixation of the diseased part: this requires different arrangements in caries of the upper and lower parts of the spine. In cervical cases the best plan of treatment is to put the child on a hard mattress, with a small pillow to fit in between the shoulders and occiput so as just to support the spine without straining it: a ring air or water cushion for the head answers very well. Sandbags not too tightly filled are then laid along each side of the neck, packed well in, and secured by one placed across above the top of the head; a folded handkerchief should be carried across the forehead and fastened to the sandbags at the side to prevent any possible lifting of the head. Arrangements should be made for defecation, &c., without disturbing the child, by providing a hole in the mattress or a separate part in the middle that can be slid out. We know no better plan than this, as advised by Mr. Hixon, where it can be carried out rigidly, but it is difficult to manage for a sufficient time. Extension by means of a head sling and weights may be applied in cases of cervical and high dorsal caries (*vide* Schappo, 'Year Book of Treatment,' 1891, p. 276). As soon as repair has fairly advanced, as evidenced by absence of pain for some weeks previously, loss of tenderness, and diminution of thickening, with drying up of any abscesses that may have

formed, the child should have on a stiff leather or pomplastic collar padded carefully to the neck and scapula, and shaped to the shoulders below: he may then begin gently and carefully to get about for a short time daily, but on the least sign of pain or swelling the original plan must be resumed.

On a jaymast may be applied with a plaster or felt jacket, either in the original form devised by Sayre, or of a shape we prefer as less troublesome, and we think more efficient, as shown in fig. 147; this form has the advantage of providing elastic support, of not requiring to be made of steel, and of not tending to press upon the vertebrae. The jaymast must be carefully modelled to the particular case, and never removed, but the straps kept just taut. Failing the treatment in bed, the jaymast is, we think, as good a plan as any, though it is troublesome to usage. Various other methods, such as inflatable rubber collars, wire-net collars, &c., are used with advantage in suitable cases, i.e. when the disease is subsiding. Extension of the head by weights, the trunk being fixed, is sometimes usefully employed, but requires care not to overstretch the softening ligaments.

Caries in the upper end and distal regions requires as absolute recumbency as cervical disease, but it may be either in the prone or supine position, and sand-bags are not required; the child should be fastened down by the simple plan shown in fig. 148 if he cannot be trusted to lie still. The jaymast plan is applicable, of course, in these cases as well, and must be used in any case where the ordinary jacket cannot be so applied as to carry the weight of the upper part of the body.

The ordinary plaster-of-Paris Sayre's jacket is in our opinion the best application for spinal caries in the lower dorsal and lumbar regions. In acute and rapidly progressing cases a period of recumbency should be insisted on, either with or without the jacket. Certain points are essential in the use of this appliance:—1. Any sharply projecting spines must be protected by padding round them, and by careful moulding of the plaster to avoid pressure. 2. The jacket must reach well up to the root of the neck in front and behind, being shaped out in the axilla; this may be done by carrying the bandages crosswise over the shoulders and cutting out the cervical part afterwards, or by careful adjustment of the strips without crossing the shoulders. 3. The lower border of the jacket must come down well over the crest of the ilium, so as to distribute the pressure and prevent the formation of sores on the crest and iliac spines. In fact, the jacket must be closely fitting and envelope the whole spine from neck to pelvis, and not be, as it too often is, a mere wisp round the waist. We generally apply these jackets in the hospital room, with the child lying on its face across two chairs with a gap between them: the tripod may, of course, be used, but with the greatest caution, to prevent any stretching, and



Fig. 147. A jaymast for Cervical and Upper Dorsal Caries. The lateral shape of the upright mast—its under surface, and its extremity in front—is of wood, which presents sufficient forward of the head, causing the head to remain vertical. The spring of the mast is supported by elastic webbing in the arms, which have been removed from the figure for the sake of clearness.

It must be remembered that the point in applying a jacket is to fix the spine and prevent any further pressure, not to pull the surfaces apart—it would be as rational to put on powerful extension and counter-extension after excision of the knee, dragging the bones away from one another, as to try to extend

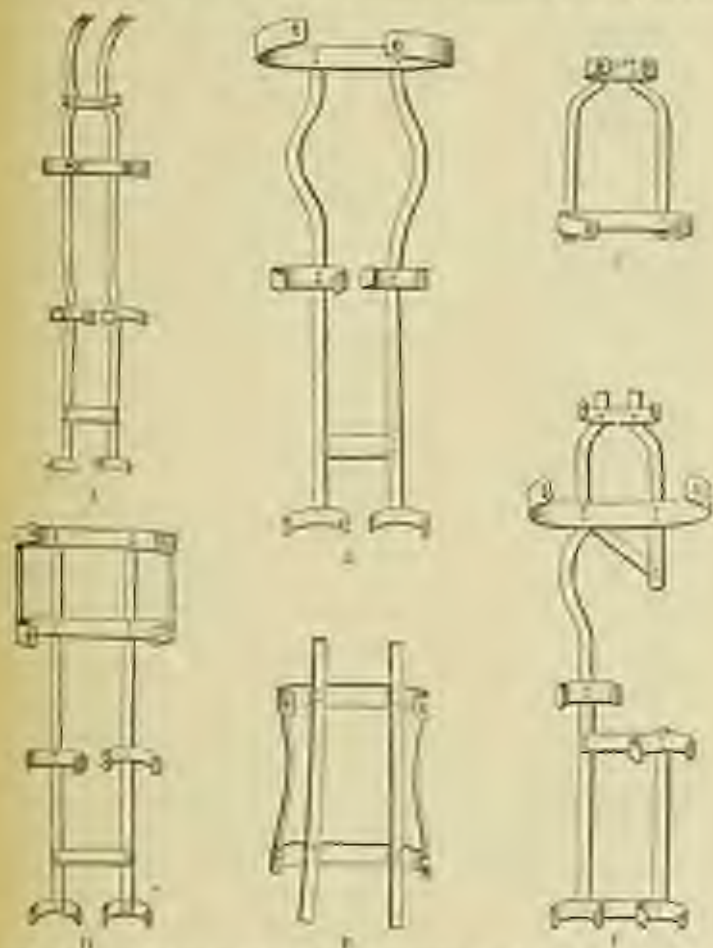


FIG. 945.—Patterns of splints for Spinal Curves, Kymograph. (a), for living head, neck, and body limbs; (b), for dorsal lumbar curve; (c), for upper thorax; (d), for dorsal thorax; (e), for dorsal lumbar; (f), for living whole trunk and lower limbs in a case of lumbar or gluteal stress, &c. These appliances are all Thomas's splints or modifications of them.

a castless spine. Of the various modifications of the jacket we have no experience, as we are quite satisfied with the results of the too jackets a year or so. With careful management a jacket will last from nine months to a year if the child does not grow out of it, but usually hospital patients require

new ones every two or three months. The plan of putting on two jerseys and changing the inner one by tucking a new one to its lower edge, and then drawing it upwards beneath the jacket by pulling the old one over the head, is ingenious and saves frequent changing in some cases. Then after a jacket

put on usually means pressure at some point, and should lead to careful examination: if at the hips or axillæ, it may be relieved by judicious packing or cutting away; if in the back, the jacket must be removed, or it will cause sores. Free dusting between the jersey and the skin with powdered boracic acid, or, in dirty people, with pale, lyol ammonia, is useful. From six to eight bandages are usually required for a jacket in a child; they should be applied in spirals so as to cross and strengthen one another, and care must be taken not to allow the edges to be thin and weak. 'Dinner pads' are not necessary if the bandages are put on judiciously; a soft patch in the jacket over the abdomen does not demand a re-application so long as the rest of the jacket is firm. In some cases, where, from the presence of abscesses in the back, or co-existent hip disease, or flexion of the legs from psoas abscess, a jacket is inapplicable, we use a double Thomas's hip splint and find it very useful; it ensures rest, keeps the spine at rest, extends the legs, and does not interfere with dressings nor require removal (figs. 148, 149). Should the child be fit to be on its legs, it can go about with crutches, in a double Thomas's splint.

Trochanteric and other jackets have only doubtful advantages over the original Sayre's, and have many drawbacks: they are rather applicable as protectors after consolidation has taken place than as a mode of treatment for active disease. Of the various special apparatus we can only speak in the same terms, but not from actual experience of them; we have never been tempted to try them.

If it were possible to reach and remove the source of suppuration in all cases, the management of spinal abscess would be that of all other abscesses in connection with bone disease, but the question is not a simple one, and each case has to be judged for itself. In cervical disease, as a rule, all abscesses should be opened as soon as they develop, for they are apt to track widely down the neck on, passing in the pharynx, to become septic or a source of danger from pressure. Hence antiseptic incision, by dissection at the pos-



Fig. 148.—Case of the spine, with double iliofemoral abscess, treated by the application of a double Thomas's splint.

inner border of the sternum-mastoid, is the best treatment. In one case, where the disease was of the spinous process alone, we opened the abscess, and lines removed the diseased spine; and this, perhaps, might sometimes be done in process of the bodies as proposed by Mr. Treves more especially for lumbar abscess. Opening the abscess in the pharynx is not a good plan, and should only be done in an emergency where the pressure is threatening suffocation; even then we should prefer to do trephining and then open the abscess in the neck at leisure, allowing the tracheostomy wound to close.

Abscess in the dorsal region is not very common; if due to disease of a spinous, transverse, or articular process, the seat of disease may be reached; if of a body, this is hardly practicable unless possibly after resection of a rib, and is probably not desirable. Abscess pointing in the lumbar, iliac, or psoas area is the condition most commonly met with; as to its treatment, our opinion is that if the abscess is on the point of bursting, or gives rise to much pain, or is rapidly increasing, it should be opened at once with full antiseptic precautions—the opening being made in the loin if there is any cavity there of sufficient size, or, if not, in some cases it is a good plan to pass a long probe from the lower opening, iliac, psoas, or gluteal as the case may be, and cut down upon it in the loin. Where the abscess is chronic and stationary, and where no adequate treatment has been hitherto adopted, and there is not much pain, it is wiser, in our opinion, to wait. The pus may be absorbed, there may be no sequestra to keep up irritation, and the cavity may subside with rest, while we cannot remove the disease if it does not subside. When once opened there is always the possibility of drainage slipping and the wound getting foul, with the usual result of slowly progressive or acute septic poisoning. As long as the child is not going downhill, it is usually, we think, wiser to leave well alone. All spinal abscesses, when opened, should be dealt with by the method already mentioned as suitable for chronic abscesses elsewhere, i.e. they should be opened freely, all their contents thoroughly scraped, wiped, and washed out; the wall of the abscess being thoroughly cleaned, the cavity should then be injected with iodiform emulsion, and the wound closed. Should there be subsequently evidence of sepsis from imperfect management of the wound, it must be opened and drained, but this must be looked upon as a serious disaster. If, however, the wound heals without loss, but the abscess gradually refills, the failure is due merely to incomplete removal of the diseased material, and the operation must be repeated as often as foul recollects. By this method excellent results will be obtained, and this is the whole question, sepsis is avoided. As to lumbar exploration and removal of sequestra, the plan introduced by Mr. Treves, we confess we rather agree with Mr. Owen that, while opening the abscess as near the seat of disease as possible is of course good, it is but rarely that we can hope to make out the exact condition of parts or find the sequestra *in situ*, and the method is, as already pointed out, only applicable to lumbar disease. Nevertheless the abscess should be explored with the finger in order to ascertain the size, shape, and relations of the cavity, as well as to reach, if possible, the original seat of the disease, and remove any sequestra and scrape or sponge out any caecous lumps lying loose in the abscess cavity. This is, of course, quite a different matter from cutting down upon vertebral bodies.

When paraplegia occurs strict recumbency in bed should be the treatment, with very careful general management and the strictest watchfulness to avoid bedsores. All discharges must be carefully cleared away and the parts kept dry and powdered with tannic acid. Occasional washings with strong spirit tend to harden the skin and prevent pressure sores. Any contractions of the limbs should be prevented as far as possible by suitable appliances. The internal administration of large doses of iodide of potassium is highly recommended by our friend Dr. Gibney of New York, but it has failed in our own hands. Mercury may be tried with advantage in some cases. Counter-irritation in the form of blisters or the actual cautery is sometimes of service. Where the paraplegia remains all treatment for a long time, the question of trephining the spine (*laminectomy*) and relieving the source of pressure is to be considered. In one case in which we operated to remove a thick layer of lymph from within the spinal canal, and a paraplegia of six months' standing, which had resisted all other modes of treatment, it soon began to improve, but the benefit was only temporary. In two of our cases complete recovery of power of walking followed the operation, but we limit its application to cases in which paraplegia has persisted after at least six months' absolute recumbency. In cases where paraplegia has come on rapidly, and is due to pressure of an abscess, the operation should *ex aequo* be done earlier (vide Thornton, 'Brit. Med. Jour.,' June 30, 1894). Dr. Macdonald has recorded some successful cases (vide Address, 'Brit. Med. Jour.,' Aug. 11, 1888). Within the last year or two a great impetus has been given to this operation, and sufficient success has been obtained to fully justify it in cases where paraplegia does not improve by long continued rest. The cord may be compressed by sequestra, or by an extradural abscess, or possibly by distortion of the spine, but more commonly the pressure is due to effusion of thick tough lymph on the surface of the theca. For details of the operation we must refer to the special works on operative surgery. After the operation some such apparatus as that figured (fig. 144, A, C, or F) should be applied until the parts have consolidated. Our own experience is that the operation is seldom called for, and that the great majority of cases of compression paraplegia improve by continuous rest in bed.

Disease of the sacrum, with abscess pointing into the rectum, is a desperate condition. The abscess is certain to be septic, and can only be reached through the rectum until it has burrowed down to the sacral notch, or unless it points at the back, as it may do. In one case we tried to remove the disease, but in consequence of an abnormal patency of the theca below its normal point it was wounded, and the child died of meningitis: the post-mortem showed that any such operation would have been exceedingly difficult, and probably intractable.

The prognosis in spinal disease depends upon the stage to which the mischief has advanced, the presence of other tubercular lesions, and the amount of cure that can be bestowed upon the case. It is not necessarily bad, and under favourable circumstances is decidedly good; but from one to three years' treatment or even more is required.

Atlanto-axial disease is, as already pointed out, rare in children; it is essentially the same disease as tuberculosis of any other joint, but its importance depends upon the effects liable to follow softening of the ligaments and

sudden displacement of the odontoid process, viz. sudden death from pressure upon the upper cervical cord. Occipital pain, rigidity and thickening of the neck, with perhaps purpura, are the general symptoms; there may be special difficulty in rotating the head. The general rules for cervical caries apply in other respects to this locality.

Disease of the **costo-vertebral** articulations sometimes occurs, either alone, or as a result of extension from disease of the spine or a rib. Pain, which may be radiating, and formation of abscess, are usually the only symptoms by which the disease can be recognised. The abscess may point either in the back or lumbar region; possibly some cases of psoas abscess depend upon this lesion. It is likely to be mistaken for spinal caries, but the absence of curvature, the slight, if any, rigidity, and the unilateral pain and suppuration, as well as the results of exploration, will probably enable the difficulty to be cleared up. Fixation in a plaster jacket with, if necessary, a window for discharge, or, better still, one of the appliances figured (fig. 148), is the best treatment if the disease is inoperable.

CHAPTER XXX

CLUB-FOOT, DEFORMITIES OF LIMBS, ETC.

THE deformity known as club-foot or talipes may be congenital or acquired. The varieties of the congenital affection are named as follows:—

Talipes varus	the simple forms.
= valgus	
= equinus	
= calcaneus	the compound forms.
Talipes equino-varus	
= calcaneo-valgus	

Talipes varus may be simple or associated with equino-varus or equinus. The only common form of club-foot is equino-varus; this deformity is sometimes called simply varus, but inasmuch as the distortion is a compound one in almost all cases, we shall consider it under the more accurate title—and this is the more necessary, since its successful treatment largely depends upon recognition of this complexity. Calcaneo-valgus is the next most common form; the others are only occasionally met with, and as great rarities anomalous forms such as calcaneo-varus and equino-valgus are seen.

The general appearance of congenital **equino-varus** is seen in the figure. The heel is drawn up (equinus) and the anterior half of the foot is adducted and rotated inwards upon an antero-posterior axis, the adduction and rotation taking place at the transverse tarsal joint. Considering the deformity more in detail, it will be found that abnormalities exist in the muscles, ligaments, bones, and fascia of the foot, and, though the subject has long been under investigation, we owe to Mr. Parker and Mr. Shattock much of our recent information upon the share taken by these several structures in the maintenance of the malposition. We use the word 'maintenance' to show that we believe that the deformity is due to persistent fixation of the foot in a distorted attitude rather than to any active displacement caused by muscular or ligamentous contraction. In describing the anatomy of talipes we acknowledge freely our indebtedness to Mr. Parker's work.¹

In talipes equino-varus the posterior ligament of the ankle joint, the anterior part of the isural-lateral ligament, and the scapho-cuneiform and inferior calcaneo-scaphoid ligaments are those which are especially tight. In addition to these the plantar ligaments and plantar fascia help to maintain the concavity of the sole of the foot which co-exists with the equino-varus.

¹ *Congenital Club-Foot*, 1892.

² Concerning the 'scapho-scaphoid space' of Parker.

In severe cases the whole of the ligaments on the inner side of the foot are shortened, and there may be adventitious fibrous bands.

Besides the ligamentous structures, the tibia posterior and antrum, as well as the flexors of the toes, the short muscles of the sole, and the muscles of the calf acting upon the tendo Achillis, contribute to the maintenance of the deformity, though it has been shown that, with the exception of the tendo Achillis, all the rest may be divided, and yet, unless the ligaments are also cut, but little effect can be produced upon the malposition. This is, however, not always the case, and it is probable that the share taken by the different factors in talipes is not always the same. Mr. Parker places the existing structures in equino-varus in early life in the following order of importance—

- (1) The astragalo-scapheoid capsule.
- (2) The tendo Achillis.
- (3) The skin of the inner border of the foot.
- (4) The bony framework of the foot.
- (5) The other ligaments and muscles.



FIG. 151.—SEVERE *Talipes Equino-Varus*.



FIG. 152.—VERY SEVERE *Talipes Equino-Varus*.

As to the bones the trochlear surface of the astragalus is increased posteriorly and diminished in front, and the neck of the astragalus is lengthened and directed more obliquely forwards than normal; the articular surface on the head lies further inwards than usual. The 'calcaneum lies in a position of exaggerated rotation inwards beneath the astragalus, and in one case was found fused with the navicular.' The lower ends of the tibia and fibula are rotated inwards. The exact form of the astragalus appears to vary with the severity of the case.

The drawing up of the os calcis tends to throw the head of the astragalus downwards, and the front of the foot is directed at the transverse tarsal joint, and so the scaphoid slips partially off the astragalus and comes to

articulate with the tibia. The cuboid, cuneiform, and metatarsals are also tilted upwards, and further retracted by the long and short muscles so as to contract the sole of the foot, thus producing cavity. In some cases all the tarsal bones show a tendency to curvature with the concavity upwards, and the direction of their articular surfaces is altered. The tibia may be entirely behind the fibula, and the tendo Achillis, being brought close to the inner ankle, may lie nearer the posterior tibial artery than in the normal foot. In a case we dissected the flexor longus digitorum lay directly over the tibia posterior. Bursae are found under the processes of the foot, and may exist even in intra-uterine life.

In early stages and slight cases it appears that the astragalus is normal in appearance; in more severe deformity it is wasted and the neck demarcated; there is not, however, any constant relation between deviation of the neck and deformity. In one case that we have seen the rotation of the foot inwards was, we thought, on the scapho-cuneiform, not at the transverse tarsal joint. The voluntary result of these changes is adduction and rotation inwards of the front half of the foot, with elevation of the heel (figs. 190, 191).

In **valgus** the whole foot is everted at the ankle or the subastragalic joint, as well as rotated outwards at the transverse tarsal joint; and, further, the sole is flattened, or in infants often curves downwards, the tibia posterior and calcaneo-scapoid ligaments being stretched and the peronei distended.

In **equinus** the tendo Achillis and posterior ligament of the ankle joint are shortened and the astragalus is drawn back, so that only the front of the trochlea is between the malleoli; there are other less important displacements of other tendons. Talipes equinus is said to be an exceedingly rare condition as a congenital deformity; we have seen a very pure example in which intra-uterine pressure marks upon the knees and shoulders were very obvious. In **calcaneus** the chief contracted structures are the extensors of the great and lesser toes, the tibia posterior, and the anterior ligament of the ankle joint; thus the foot is flexed upon the leg and the point walks upon the heel; the front of the foot may be much ankylosed. The neck-like surface of the astragalus is prolonged forwards as far as the navicular facet, and the outer malleolar surface is prolonged forwards (Parker and Shumack). We have noticed extreme projection backwards of the os calcis in congenital calcaneus, as if the foot were partially dislocated backwards at the ankle, a deep depression existing over the front of the joint. Hollow club-foot (**cavus**) depends upon shortening of the muscles of the sole of the foot and the plantar ligaments, as well as the flexors of the toes, the tendo Achillis, and the tibia posterior. By the arching of the foot and the drawing up of the heel the extensors of the toes are put upon the stretch, and hence the toes are drawn up in hyper-extension, so that the deformity known as 'hollow club-foot' is usually produced.

The compound forms of talipes need no special description, as they consist of combinations of the simple varieties.²

Ætiology.—Many theories have been proposed to account for the origin

¹ So that valgus is not the exact opposite of varus.

² Vide Mr. Parker's book.

³ Holmes' *Lectures on St. Barth's Reports*, vol. ii. 1846 describes a case of 1839.

sense of club feet, and it is probable that most of them are true in certain cases; we do not think any one cause alone will explain all cases of club-foot.

Littles considered talipes due to 'a morbidly excitable, retractile disposition of muscles, comparable to the reflex tonicities of later life.'

Central and peripheral nerve lesions, causing spasm or paralysis of muscles, may account for some cases, where, for instance, spina bifida or absence of brain (anencephale) is associated with talipes; on the other hand, Parker and Shattock found both cord and nerves perfect in a case they examined. In opposition to them, however, we must point out that the position of the talipedic limbs is often cupated, and they are fat, fleshy, and tendinous; the muscles may, however, react normally to electricity; intra-uterine pressure associated with deficient amniotic fluid (Crucetier) is no doubt the cause in some children. We have found talipes associated with intra-uterine constrictions and amputations from amniotic bands,¹ and in another case, alluded to above, the deformity co-existed with presacral marks; but the distortion is also found when the liquor amni is abundant, and such explanation hardly accounts for single talipes as the only malformation.

A persistence of the natural early fetal position (Kocher) explains some cases of equino-varus and, later, calcareni; in others, again, deficient development of parts is the cause, as in cases where congenital absence of the fibula has produced valgus, and this may be compared with fig. 162, of absence of the radius producing club-hand.² Huxley supposed that obliquity of the neck of the astragalus was a cause, but, as shown by Parker this may occur without talipes, and talipes may exist without it. Intra-uterine joint disease possibly explains some cases, and adhesions are found in certain instances in the joints. Crucetier, Freyer,³ Parker and Shattock, and Snick have pointed out that where the limbs are interlocked in abnormal positions they will exert pressure on each side quite independently of the amount of fluid; we have frequently seen cases where clearly the feet had unlocked: the one foot, being in a position of extreme calcareo-valgus, was forced into the concavity of the other, which had severe equino-varus.⁴ For further discussion of the subject we must refer to the admirable works, so often quoted, of Messrs. Parker and Shattock, and, in acknowledging our indebtedness to them, we can confirm many of these observations by our own; we think that nearly, but not quite, all of the cases can be explained mechanically by pressure or position *in utero*, bad packing as it were, and

resulting in rigidity of the tendo Achillis with subsequent development of flat-foot, of which it appears to be an early stage; he calls it 'rectangular talipes equinus,' the foot being bent at a right angle with the leg.

¹ Possibly this may be explained by the absence of normal exercise *in utero*, when the feet are interlocked or cupated.

² Parker and Shattock also mention a case of this.

³ Chakland is, however, probably the result of pressure causing arrest of development of the proximal border of the foot.

⁴ *Monographs der Anatomie*, Teil. viii. fig. 1, from Crucetier; the figure is copied in Huxley's, as the subject had also been there (1851).

⁵ Confirmation of this view in the causation of cupus is found in the other deformities usually produced, such as 'great hemiplegia, &c.' Phillips, loc. cit.

so-called 'club-hand' is, we believe, due to the same cause. One of the strongest proofs, to our mind, is the tendency seen in children to assume, long after birth, the position they occupied *in utero*, with the feet or hands locked in the talipedal attitude. The result of habitual positions in producing curved bones in rickety children is interesting also in this relation (see figs. 71, 72, and 76, 77).

It is sometimes said that talipes is merely an arrest of development, a 'failure to unwind' the foot from its earlier or later foetal position; we think this hardly fully expresses the truth, there is something more; an actual pressure and squeezing together of the parts in an abnormal position—certainly what has occurred—is most of the more severe cases at any rate.

As to the degree of deformity, we cannot do better than quote Dr. Parker's words: "When the cause begins to act very early in, and continues throughout, intra-uterine life, the deformity will be a very fundamental one; whereas, if the cause begins to act at a later period, or if it be continued for a short time only, the resulting deformity will be less severe."—*Brit. Med. Jour.*, October 27, 1883.

The *treatment* of all cases of club-foot in children can be successfully carried out without any but the most simple apparatus, except in the few instances where, from neglect, old cases may require amputation; we shall, therefore, confine ourselves to description of the methods we have found most useful, and omit all reference to costly and complicated appliances. The general principles of management are the same for the different forms of club-foot, so that we may take an ordinary case of equinovarus as a type. Several questions have to be considered, such as: (1) When is treatment to be begun? (2) Is a cutting operation to be performed; if so, what structures should be divided, and at what age? (3) When operation is required should all the tense structures be divided at the same time, and should reduction of the deformity follow immediately on the operation or be delayed? (4) What is the best apparatus to apply? (5) How long is treatment to be continued?

(1) It might be thought unnecessary to insist upon the treatment of club-foot being begun immediately after birth, but we have more than once had cases, several months or more old, brought for relief, in which not only had nothing been attempted, but the friends had been told the child was not old enough for any treatment yet. Of course with a child a few days old more can be done in a week than is possible in a month with an older child. Treatment should be begun without a day's delay. (2) The question of operation has been allowed to become largely one of failure, some surgeons advising it in nearly every case, and others insisting not only upon its needlessness, but upon the harm resulting from it. The rules we follow on this point are:—If the child is seen within the first few weeks of life, operation is very rarely, if ever, necessary. During the next two or three years two points have to be considered: first, what amount of cure can be expended upon the case; and secondly, how rigid are the resisting structures, i.e. can the deformity be reduced by moderate force? If the child can be thoroughly well looked after, and its splints applied regularly and intelligently, operation is not necessary in most cases under two years old, although it undoubtedly shortens the time required for reduction, and is sometimes desirable—certainly in

where there is much rigidity, and any doubt about the efficiency of the case and management. Where the rigidity is so great in a child over three months old or thereabouts that the deformity cannot be completely reduced by reasonable force, operation should at once be performed; such cases are, however, comparatively rare. We see no advantage in forcible 'redressment' over a cutting operation. (3) In equino-varus there is, we think, little doubt that if all the resisting structures are to be divided, those which maintain the varus part of the deformity as opposed to the equinus should certainly be cut at the same time, and before there is any attempt to rectify the equinus. The plantar fascia rarely requires division except in neglected cases. Authorities differ as to the risks of immediate reduction after tenotomy. We do not think the matter is one of great importance, and generally settle the question by the interval that is to elapse before the next visit; if more than two days, we usually correct the deformity at once. (4) As to the question of apparatus we may say at once that we have never used, or seen the advantage of, the more complicated instruments—shoes modified in various ways from Scarpa's, Talbot's, and so on; they are too expensive for the hospital class, and in all classes we are quite satisfied with the results to be obtained by much more simple means.

Practically we find one of three appliances will meet almost every case: two are of Dr. Little's invention, and the third is a slight modification of Russell's artificial muscle plan. To take a case of equino-varus in which the varus is to be remedied first. The first appliance is adapted only to infants or children a few months old. It is simply a strip of thick block-tie long enough to reach from the knee to just beyond the end of the toes when the foot is pointed (fig. 132). This is bent to fit the foot along its outer side in its full equino-varus position. It is then bandaged on, no attempt being made to remedy the equinus or varus; when it is securely fixed to the leg and foot, the front of the foot (i.e. the part beyond the transverse tarsal joint), together with the toe, is gently bent outwards so as to slightly improve the varus, leaving the equinus unaltered. The foot is left in this position till the next day, or longer if absolutely necessary, when the bandage is removed and a little further correction employed, and so on till the varus is somewhat over-corrected. The equinus is then dealt with in the same way, the splint being applied to the back of the foot. The second appliance (fig. 134) is simply Dr. Little's tin splint. It may be used with the foot-piece fixed at a right angle with the leg-piece, or better movable, so as to remedy the varus alone first. This splint is applicable to older and more rigid cases, as it is a much more powerful appliance than the last. It is useful sometimes to have a slit cut in the metal at the angle between the leg and foot pieces, running a little distance along the edge of the sole; through this slit the bandage is carried, and on the heel is more securely fixed down. The third apparatus is Russell's artificial muscle, applied somewhat differently. We use it in two different forms. The first form consists of Mr. Russell's strip of tinned iron strapped to the front of the leg; on it is soldered a hook. A strip of strapping, or webbing, or felt is carried round the front of the foot, and to its free end is fixed a loop of stout india-rubber cord, or drainage tubing; this is then stretched up to the hook above, so as to correct the deformity. The second way of applying the muscle is that

shown in fig. 257. The object of using the straps instead of the tin splint and plaster is to allow the apparatus to be taken off in order to rub and wash the leg, friction being a point to which we attach considerable importance, as tending to prevent, or at least remedy, the green stifle which occurs in the course of the treatment of talipes if any rigid appliance is kept on constantly. The plan we adopt usually is to use one or other of the tin splints, generally the first, until the deformity is so far corrected that the muscle can be efficiently applied; the latter is then worn till the cure is complete.

As to the duration of treatment no hard-and-fast rule can be laid down; it varies in each case with the rigidity of the parts, the age of the patient, and the care expended upon it. In one case a few weeks; in another many months, may be required before the artificial muscle stage is reached. As



Fig. 256.—Tin Splint from the System.

Fig. 257.—The Artificial Muscle Apparatus, showing the deformity in a case of Congenital Equinovarus (club-foot). 1, the tin splint; 2, the straps; 3, the foot; 4, the sole stage, connecting the upper and lower straps. The apparatus is a modification of the really original plan. It is better, as here the straps are kept as tight as they can be.

Fig. 258.—Corrector Tin Splint, which may have a part of the position of the sole and leg pieces.

soon as this can be probably applied the disability of the limb is over, but the cure cannot be considered cured; hence the answer to the fifth point, that of the duration of treatment, can only be general. As Dr. Little points out, no case is safe from relapse until the patient is old enough to watch himself and correct the earliest sign of return of the deformity, although by the age of the artificial muscle another decision of him, that there must be no walking till the deformity is remedied, may be set aside. Great care is required, in applying the splints, not to be deceived, by the redness of the limb, and until the artificial muscle can be applied so as to slightly over-correct the deformity no walking is to be allowed; after this point is reached it does no harm, but serves good. The essence of the matter is largely in the amount of trouble taken with each case by the surgeon and the friends.

Some other points in management must be also considered. Manipulation, i.e. firmly holding the foot in a slightly over-corrected position, is

exceedingly useful, and should be daily employed each time the splints are removed—or, if unfortunately, from pressure sores or other causes, the apparatus has to be left off, frequent manipulation prevents time from being lost. The leg should be firmly grasped in one hand, in such position that the patella looks directly forwards, and then the other hand should be used to steadily turn the foot into position, bearing in mind, in each case, the seat of the deformity: thus in valgus the ankle joint must be straightened and the rotation made at the transverse tarsal joint.

Pressure sores are to be avoided by regular daily renewal of apparatus, and avoidance of rubbing up of plaster or bandages: though, perhaps, snugging is more apt to cause sores than webbing,¹ it is easier to keep on in the early stages of treatment: yet, however, generally use this saddler's felt or webbing for the foot-strap, and carry it round the ankle and foot in the fashion shown in fig. 136, but covered (B, fig. 153).

Should it be decided that tenotomy is required in a given case, the rules for its performance are as follows. To divide the tibialis posterior the limb is laid upon its outer side upon a firm pillow, the posterior border of the tibia is felt for, and the tenotome passed in two fingers' breadth (in an infant) above the inner malleolus, in such position that its point just hits the edge of the bone: the knife is then slipped close to the bone, between it and the tendon, and its edge turned towards the tendon: the foot is then held so as to correct the deformity, and by a gentle levering action the tendon is divided, cutting towards the skin: as soon as the tendon is felt to snap the knife is withdrawn and a collodion pad and bandage applied. Occasionally bleeding is free, but readily stops on pressure, and no bad result follows. If the edge of the tibia cannot be felt, a point midway between the front and back of the limb marks its position. The better plan is to divide the tibialis posterior, together with the ligaments, through one puncture opposite the transverse tarsal joint in the posterior crease of the sole.

The tibialis anterior is best divided upon the dorsum of the foot, just before its insertion into the inner cuneiform: it is easily felt, and the knife passed beneath it, and division effected as in the posterior tendon.

The tendo Achillis is perhaps the simplest of all. It should be cut about 1 inch above its insertion, at its narrowest part, the knife being passed mid beneath it (i.e. nearer the tibia), from the inner side while the limb lies on its anterior surface. Personally we prefer to pass in the knife while the tendons are held taut and can be plainly felt; others prefer to tighten only after the tenotome is beneath the muscle.

We are much in favour, in suitable cases, of Mr. Parker's plan of dividing all rigid structures at the transverse tarsal joint, and not limiting the section to the tendons or ligaments. The tubercle of the scaphoid should be felt for and the knife passed into the inner border of the foot, just behind the bone; the edge is then turned towards the joint and made to cut well into it, dividing everything until the foot readily yields: by thus severing the ligaments subsequent reduction is rendered much easier. Where this plan is adopted, the tibialis posterior and anterior are divided at the same time as the rest of the rigid structures; the internal plantar artery is necessarily cut, and we have once seen a traumatic aneurism result, but no serious ill-effect need be

¹ With Gelling Band, Goy's Hospital Report, 1882.

feared, even if bleeding is free at the time.¹ The anterior and posterior ligaments of the ankle joint require division in some cases of calcaneus and equinus respectively.

It should be remembered that in several instances the characteristic snap is often not felt.

We are not satisfied with the results of fixing foot in plaster of Paris, either with or without tenotomy, but much prefer an arrangement where the pressure may be altered frequently.

Where the artificial ankle plan is being employed, if tenotomy is required at all, it is usually the tendo Achillis that needs division, since the plaster is apt to slip up towards the heel in such cases. Where the other splints are used, it is better, since the varus is corrected first, to divide the tibial tendons, &c., three or four weeks before the tendo Achillis; some surgeons prefer always to divide the Achilles tendon first. The peronei rarely require division (we have never seen a case suitable for peroneal tenotomy); if they do, the section is made on fingers' breadth above the outer malleolus. The extensor digitorum and proprius hallucis may be divided just below the annular ligament, but we have never found the operation necessary.

Congenital valgus is best treated by a muscle applied as is to exert pressure in the opposite way to varus; it is, however, not so readily corrected. The rare equinus requires muscles on both sides to draw up the foot, usually after tenotomy. Calcaneus is best treated by the tin strap (fig. 142) or jointed splint (fig. 154).

Talipes cavus is often remedied by division of the tendo Achillis only; in other instances the existing structures in the sole may require section. Where there is much cavus with equinus it is sometimes necessary to attach the 'muscle' to a thin metal plate moulded to the ball of the foot, to prevent the foot-screw from slipping into the hollow of the sole.

There is no doubt that tenotomy alone is in many cases inadequate, and with the exception of division of the tendo Achillis, he largely gives up in favour of the more complete and scientific operation of 'syndesmotomy' (division of ligaments) described by Farlow. Of 'open division' of all the existing structures, including the skin, we have little experience; we have, however, had one or two cases in which after 'syndesmotomy' at the transverse tarsal joint the skin has given way under the strain of forcible reduction of the deformity. The only harm resulting has been delay in the healing of the wound and some little increase in difficulty in the application of the 'muscle.' The principle of the plan does not commend itself to us.

Excision of one or more bones of the tarsus for inveterate club-foot, as employed by Davies Colley, Dary, Lund, and others, is an operation to be reserved for severe cases in older children, and only employed when there is no hope of remedying the deformity by other means.

The operation we prefer consists in making a \perp shaped or arch incision on the inner side of the foot, the horizontal limb running along the inner border, and the vertical part passing across the centre of the cuboid. The flaps are reflected, the bones exposed, the tendons being drawn aside, and a wedge of bone is removed either in posterior or anterior

¹ Other cases of necrosis following division of the plantar fascia are on record—vide *Walsham, Lancet*, January 28, 1881.

side of the foot; a cloth is the most convenient instrument for the purpose. Various lines of action are employed, but the general rule is to remove the callosities always, and as much of the adjacent tissues as the individual case may require; the transverse band of the ganglion, bands of the metatarsal bones, and bend of the os calcis may all require to be taken away.¹ After the operation the foot should come readily into position; all bleeding having been stopped, and the dressings applied, the limb is at first fixed lightly in a band splint. The wound often heals somewhat slowly, and until it is superficial we prefer not to use frolic corrective apparatus; usually in about a fortnight a plaster may be applied. It is a good plan to take away an oval piece of the thick yellow skin and the underlying bone from the dorsum of the foot. We look upon the operation as a very valuable one in suitable cases—for instance, where the patient walks upon the dorsum of the foot and pressure sores are prone to develop; while all the circumstances are rapid (vide fig. 314).

Excision of the astragalus alone, we think, is best adapted for paralytic cases—in such instances we have obtained the best results; it may be done without division of any important structure, by an incision over the ankle joint, carried down the tibia to the tibiocalcaneal tendon, and another one at right angles to this, along the inner border of the latter tendon. By a little careful dissection the bone may be got out, the only difficulty being with the articular ligaments. After the operation a thorough rest with a good arch will remain.

The most common forms of **paralytic (acquired) Talipes** are equinovarus and valgus; these, so far as the deformity goes, are usually readily treated by the artificial muscle method, and the effect is generally immediate and to a certain extent satisfactory; it does not, of course, remove the weakness and flabbiness of the foot, but it prevents actual turning outwards or inwards, and makes walking much steadier and more slightly. In some few cases light steel supports are of value. Where, however, from long neglect the deformity is intractable by these means, the method of excising the astragalus already described may be required. In very severe cases of infantile paralysis, where the foot is perfectly paralytic, and especially where the paralysis extends along the knee, and the knee joint is flexed, the limb being flail-like, short, and useless, amputation may be required; this, however, should never be done in childhood, since there is a possibility of improvement. The attempt to convert the flail-like distorted limb into a stiff stable support by resection of the knee and ankle joints ('arthrodosis') has been tried, with unsatisfactory results, in some cases; in a case we operated on in 1884, there was very considerable improvement—this was, we believe, the first case operated upon in this country. Walsham² has practised shortening the tendons by excision of a part and suture of the divided ends, thus correcting the deformity and allowing the lax muscles to act; we have also tried the plan, with fair results in two or three cases. It is sometimes of much value.

¹ The principal modes of amputation are:—

1. Excision of a wedge of bone, proportion of joint lines (Dewees Colley).
2. " " " " resect (Latter).
3. " " " " astragalus (Lamb) (chiefly, we think, applicable to acquired talipes).
4. " " " " astragalus, resect and scaphoid (West).
5. " " " " wedge from the neck of the astragalus (Hansen).
6. Lower extremity of the tibia or of the leg above the ankle joint (Hahn).

² Excision of a wedge from the transverse tarsal joint, &c. (Rothgum).—*See* *Scythop. Berlin. Klin. Woch.* February 4, 1893; also *Lancet*, Vienna Clinic, *ibid.* II. 1, vol. 5; also *Goldschmidt, Ann. Med. de Strasbourg* & *L'Enferm.*, from Gerhardt, *J. Clin.* No. 27, April 1884.

³ *Brit. Med. Jour.* June 1884.

These paralytic limbs are, of course, prone to become the seat of chilblains and ulcers from defective nutrition.

Apart from the cases above mentioned of paralytic talipes, where the structures are loose and flabby, are the deformities in which contractions have taken place as a result of paralysis of certain groups of muscles. Of these the most common are talipes cavus (arcatus or plantaris), in which after paralysis of the extensors of the foot the muscles and ligaments of the sole and calf contract, producing varying degrees of deformity and concavity of the sole of the foot, together with elevation of the heel (*equinus*). In some instances the pointing of the foot produces secondary contraction of

the toes (bowed claw-foot) by the strain of the extensors of the toes. The distortion resulting from the conflicting forces occurs mainly at the ankle joint, the medio-tarsal and the metatarsophalangeal joints. All grades of deformity are met with, from slight exaggeration of the arch of the foot to the most extreme equinus. Much more rarely the converse deformities are met with.

In slight cases, manipulation or the use of artificial muscles without any operation will remedy the distortion, but in the severer forms of discharging cancrs and equinus, division of the tendo Achillis, or of more or fewer of the restraining structures to the sole,



FIG. 115. Acquired Talipes Curvus (muscle, possibly from an infantile paralysis).

will be required. After operation an artificial muscle should be used, and kept on till all tendency to re-contraction has ceased. In troublesome cases of 'cavus' we attach the artificial muscle to a thin steel sole plate, which is modelled to fit over the balls of the toes, and so get over the difficulty of the tendency of the foot-strap to slip into the hollow of the foot. Some good figures of these cases are given in a paper by Mr. F. R. Fisher, 'Lancet,' January 19, 1889.

Patients, the subjects of club-foot, often suffer from complications of this condition. Blisters develop over the points upon which pressure is made, and these may become inflamed and suppurate, giving rise to obstinate sores, which will not heal and acquire callous edges. In some cases rest and ordinary treatment suffice, in others taraxacum or even amputation may be

called for. Pirgoff's or even Chopart's operation should usually be done in such cases in preference to Syme's amputation.

The whole foot and leg in severe cases is smaller and weaker than the other, and often shorter. The wasting of muscles, &c., is extreme in some instances, even when no paralytic condition has existed.

The movements of the ankle joint become altered, and it develops into a ball-and-socket rather than a ginglymoid joint (Jerg). The metatarsal bones are usually shorter than normal, a condition due to the contraction of the plantar fascia, according to Boeck.

Treatment of club-foot in all cases must be kept up constantly until all tendency to relapse ceases. Dr. Little remarks that such patients require suckling until puberty, and, as already pointed out, the result depends entirely upon the amount of care and perseverance expended upon them.

Relapsed club-foot after tenotomy is much more difficult to treat than it is in cases where nothing has been done: tenotomy should, however, be repeated and the usual methods carried out.

Flat-foot.—Apart from congenital and paralytic valgus is the common condition known as spurious valgus, *pes promtus acquisitus*, *pes planus*, or commonly flat-foot. Though this affection is not by any means peculiar to childhood, it most commonly comes on in the later years of childhood or adolescence: sometimes, however, it occurs earlier.

The condition is essentially one of relaxed ligaments and muscles, and comes on usually in weakly, overgrown children, who have been kept too much on their feet—especially if they are rickety also. It is one of the maladies arising in so-called 'rickets of adolescence.'

The prominent part assigned to relaxation of the inferior calcaneo-scaphoid ligament in the production of flat-foot is hardly deserved, since the tibial muscles, the flexors of the toes and pollex, the short sole muscles, the plantar ligaments, the plantar fascia, and the peroneus longus all take a share in supporting the arch, and the condition is in most cases the local expression of a widely spread weakness rather than the result of yielding of any one structure. In a few cases flat-foot is the result of injury.

Lowering and inward projection of the head of the astragalus, with loss of the arch of the foot and its elongation, are the prominent features of the affection. The sole may be flat or even convex, and the inner border early becomes convex also: there is usually pain over the head of the astragalus, often also across the dorsum of the foot and beneath the outer malleolus, and very commonly also in the first metatarsophalangeal joint (so-called 'metatarsalgia'). Often the patient applies for relief entirely because of the pain in this joint.

The prominent projecting mass on the inner aspect of the foot is not, however, by any means always the head of the astragalus only: it is often the tubercle of the scaphoid, since this bone is frequently pressed downward and inwards by the astragalus, so that yielding takes place rather at the scapho-cuneiform than at the astragalo-scaphoid joint. In some cases the prominence is shared equally by the astragalus and scaphoid. In any case where the deformity is marked there is a deep depression on the dorsum of the foot, due to the slipping away of the head of the astragalus.

In early stages the deformity is only seen when the patient is standing,

when the whole foot may be seen to collapse and spread out in a senseless fashion, the transverse arch also giving way. In later stages the foot becomes fixed in its distorted position, and cannot be replaced. In intermediate stages replacement is possible; sometimes in manipulating the foot adhesions give way and the arch is restored for the time. These adhesions are the result of chronic inflammatory changes which are specially prone to

occur in the metatarsophalangeal joint of the great toe, but may attack several joints and the sheaths of the tendons.

The treatment of this disease consists in preventing the child from standing long at a time, and improving its general condition; next, the deformity must be reduced; in ordinary cases an artificial muscle, applied so as to support the head of the astragalus, is perfectly efficient in relieving pain and restoring the arch of the foot, and any reasonable amount of standing and walking can be done from the first as soon as this is applied. It is the only form of apparatus we use now, and it very seldom fails if properly applied. In some cases it may be necessary to break down adhesions first, but in children this is rare. It is, however, important that the foot be moulded into good shape each night and morning. (Fig. 145.)

Standing and walking on tiptoe, dancing, and friction are all useful supplementary means, as pointed out by Ellis,¹ who is of opinion that the flexor digitorum profundus is a very important factor in tying together the pillars of the arch of the foot ('Lancet,' February 9, 1884).

No operation is ever required for acquired flat foot in children.

A form of distortion is which there is adduction of the foot, or rather rotation inwards, in which the deformity depends upon a rotation of the whole leg, is sometimes met with. It gives rise to the condition popularly known as 'duck-foot.' The unsightly gait may be



Fig. 145.—Shows an Artificial Muscle applied for Flat-foot.

due to congenital malposition or to rickets; it has been proposed to call the deformity 'club-leg,' and to remedy it by osteotomy of the femur (vide

¹ The best paper on the subject with which we are acquainted is that by Mr. Girdle Bird, already alluded to ('Guy's Reports,' 1884). From it we have learnt much.

² Some surgeons believe that weakness of the peroneus longus is the essential factor in flat-foot, and recommend division and gypsation.

1868, chapter on RICKETY DYSCHONDRAS; also Parker, 'British Medical Journal' Oct. 27, 1883).

Wry-neck or Torticollis is a fairly common affection in childhood, and may be due to any of the following conditions:—

1. It may be congenital, probably due to malposition *in utero*—sometimes to mal-development, as in a case of our own, in which wry-neck, deficient development of the external ear, mastoid region, and lower jaw co-existed with distal palatal and mental deficiency.¹

2. It may result from injuries at birth, lacerations of vessels, &c. Volkmann has found the sterno-mastoid represented by a band of cicatricial tissue. Sterno-mastoid tumour (p. 23) is sometimes followed by torticollis, the injured muscle subsequently becoming contracted. We have had at least four cases in which there was a history of sterno-mastoid tumour in infancy. See D'Arcy Power, 'Med. Chir. Trans.' vol. lxxvi., 1894. Peerssen, however, thinks the haematoma is a result of injury to the previously shortened muscle.

3. It may be spasmodic, due to central or peripheral nerve lesions or reflex irritation.

4. It may result from suppuration in the neck, due to either glandular abscesses or cervical canals, causing swelling together of the parts and contraction of the muscles.

5. Burns or other injuries may, of course, produce cicatricial torticollis.

In its most simple form, wry-neck is due to contraction limited to one sterno-mastoid, which is felt as a hard tight cord in the neck; the head in such cases is drawn down towards the shoulder, and the face turned towards the opposite side (fig. 137).

Golding Bird² is inclined to consider the condition due to a cerebral lesion analogous to the cord lesions in infantile paralysis.

In other instances the sterno-mastoid is not alone affected, but the scalenes, trapezius, and cervical fascia contribute to the deformity.

Treatment.—In slight cases in quite young children regular daily stretching and manipulation of the rigid muscles may suffice to get rid of the deformity. In the severer forms of the affection tenotomy is the only efficient treatment. The sterno-mastoid, and sometimes the trapezius, require division. For tenotomy of the sterno-mastoid the knife is passed through the



FIG. 137. Congenital Wry-neck.

¹ Interference of more or less developed cerebral lesions may produce wry-neck of one kind, in a way lateral curvature.

² See 'Reports,' 1820; vide also Murray, 'Liverpool Med. Chir. Assoc.' July 1856.

regular attempts should be made to remedy the distortion: friction and gently stretching of the neck with the hands should be tried, and the child made to practise, before a looking-glass, trying to hold the head straight. To supplement these means, various apparatus, collars, &c., may be used; the one we have found most efficient is that figured for use after tenosynovitis. In quite young children, of course, no voluntary help from the child can be obtained, but the friends must be instructed what to do, and in older patients it is a good plan, as Mr. Roth has pointed out, to get the child familiar with the exercises before the tenosynovitis is performed, so that no time may be wasted afterwards.

Congenital cases, where the sterno-mastoid alone is involved, are usually completely curable; many of the sporadic cases get well either spontaneously or after removal of some source of irritation. In cases where the scales are involved there is more difficulty. So far as we know, these muscles have not been divided for such condition, but there seems no reason why they should not be, provided a suitable case occur. In many of these patients the face is undeveloped or distorted on the affected side: secondary lateral curvature of the spine may also result.

It is certain that the condition already described as sterno-mastoid tumour sometimes leads to subsequent development of torticollis from cicatricial contraction of the muscle, and Owen has actually watched such a case; in the many cases we have seen, such result has followed in at least four instances, and Dr. Arcy Power has collected a number of other cases. *Q. 20*

No treatment is required for the sterno-mastoid tumour except that watch should be kept for the slightest sign of onset of the torticollis, and suitable preventive exercises employed (*vide* also pp. 22, 23).

Congenital Deficiencies and Malformations of Muscles are often slight, and interesting from an anatomical rather than a surgical point of view; in other instances, such as those where the pectoral muscles are absent, in association with arrest of development of the chest-wall, the malformations are formidable; in others, again, some help may be obtained by elastic cords ('artificial muscles'), or possibly by the transplantation of muscle flaps; for the most part, however, these conditions are beyond the present reach of surgery.

We must just mention the very rare condition known as *syndactyl myofascia*, of which a remarkable instance was lately under our care. The patient was a child of six years old; the affection began about a year before and was steadily progressing; cervical, pectoral, brachial, abdominal, intercostal, and femoral muscles were many of them more or less affected, without any disturbance of health so far. No cause is known for the disease, and no treatment seems to be of any avail; the subjects of it usually die from interference with the respiratory movements or some intercurrent illness, though they may live for years.

Tenosynovitis is an affection common in, but by no means peculiar to, children. Tubercular tenosynovitis is, however, not rare, usually as a secondary condition to joint disease, but occasionally occurring alone; its existence is to be suspected when swelling and suppuration occur in the course of a tendon in a tuberculous subject, and its treatment must be on

general principles—rest and constitutional resources in early stages, and careful scraping out in the severer ones. We have none or twice seen ossification in the large palmar sheath, and in one instance it occurred in a premature child only a few weeks old, coming on without assignable cause; secondary pyogenic abscesses elsewhere followed, but the child ultimately got quite well.

Bursæ in children are not usually very well developed. Patellar bursæ is, however, not very rare, and we have seen it lead to disease of the knee-joint; the olecranon bursa is also occasionally enlarged, while effusion into the semi-membranous bursa is not uncommon. Ganglion is most common in the radial extensor tendons and in those of the thumb; in recent cases the fluid may be dispersed by pressure, in others it should be punctured with a grooved needle and the clear gelatinous contents let out; a pad with firm pressure should be kept on for three weeks afterwards, or the sac is likely to refill. In obstinate cases the sac should be laid open and as much of it as possible dissected away.

Malformations.—Other congenital malformations may be conveniently considered as (1) those due to errors of growth in the embryo itself—inherent errors;—and (2) those due to abnormal intra-uterine innervation—acquired errors; or they may be classified as deformities by excess, deformities by deficiency, and deformities by disunion. In either case it is somewhat difficult to assign to their proper place all the malformations met with, and fortunately it is of little practical importance, as far as treatment goes, that we should do so.

Among inherent errors may be classed supernumerary fingers and toes—polydactylism; some cases of web fingers and toes—syndactylism; triphalangism; congenital tumours of the dermoid class—with which might be put the cases of so-called fetal inclusion. Possibly somewhat less marked malformations, such as those affecting only some of the structures of a limb, congenital varicos, venous and lymphatic, congenital muscular abnormalities, &c., should be placed here, though these, in so far as they are of surgical importance, are more conveniently considered under the organs to which they belong. Many instances of inherent errors are better seen in the head and trunk, such as failure of closure of the dorsal and ventral hæmæ and of the rhinal arches of the head, meningocele, spina bifida, harelip, ecto-version of the bladder, &c.

Among acquired errors are all those due to intra-uterine pressure, either by the walls of the uterus itself, by amniotic bands (Guth),¹ by pressure or violence applied to the uterus from without, or by mere constriction of the foetus in utero, at whatever period of gestation they arise.

In considering what malformations should be placed in this group we must remember that it is possible that pressure or violence acting in a very early stage of development leaves much less obvious signs of injury than if it is inflicted at a later period; thus constriction or pressure during the later

¹ *Views of embryology.*

² Or, as Mudgeover has pointed out, by bands of hyaline breaking from the wall of the uterus to another; (*Intero-uterine Anomalies* p. 146, and vide Todd's *Embryology*).

months of pregnancy may leave distinct cicatrices, while the same forces applied earlier may cause deficiencies without any marks of violence or strain.¹

In this group will be placed deficiency of limbs, fingers, &c. (*intra-uterine amputation*), as examples of the highest degree of deformity; also congenital constrictions and dimples, together with congenital syndactylism or deficiencies of parts or the whole of a limb, such as absence of one or more of the carpal or tarsal bones,² of the lower end of the radius or ulna, causing club-hand; or mere faults of position such as are found in club-foot, flexed or hyper-extended joints, &c.

The proof that some of these deformities are the result of errors of the embryo, and others of abnormalities of the environment (intra-uterine pressure, &c.), is in many cases easy, in others impossible. Thus polydactylism and congenital tumours cannot be the result of intra-uterine pressure, while congenital deficiency of limbs is shown to be at least sometimes due to constriction by the fact that the amputated limb has been found lying loose *in utero*, and in other instances the limb has been found incompletely severed, or even an unhealed stump has been present. On the other hand, the absence of the amputated limb and the smooth, scarless appearance of the stump sometimes met with, may be explained by the fact that the limb may become disintegrated by maceration *in utero*, and if the separation took place at a very early stage the scar might disappear during growth or become indistinguishable from its small size. Pressure, again, might well produce entire arrest of growth of a limb without amputation, and that no arm would be left, while in other cases pressure might produce fusion of parts together, as in web-fingers.³ Evidence in favour of this is afforded by the coexistence of amputations with webbed fingers (both, in such cases, the result of pressure, though even here the webbed condition may have been due to mere retarded development from constriction).

CASE.—*Hand Fingers and Toes*.—Albert B., age 5 months; admitted November 2, 1886. No history of deformity or maternal impression. Left hand, second and third fingers removed as far as the first interphalangeal joint; there is no nail on the first finger. A very imperfect nail on the second. Right hand, the first finger has a deep constriction around the first phalanx, with a bulbous enlargement of the end of the finger; the second finger has a similar constriction, but the part beyond is small and almost without nail. There is a very deep constriction round the right leg, about one inch above the ankle, almost reaching to the bone. The child can stand on the leg and moves the foot freely. Left foot, there is only one phalanx in the great toe, and no nail; the nail of the second toe is very rudimentary, and there is a small webgrowth at the fourth toe. Right foot, toes perfect, but the feet are hyperextended and flat. November 5, Daint's operation on the hand. 31st, leaving still. (Left limbs removed.) Thus have healed happily, but there is some granulating surface. Now December 12, November 12. The legs subsequently grew very partially, but were again nearly healed, when the child died of bronchopneumonia.

¹ Vide *Med. Lib.* Trans. 1877 for a case of complete atrophy of both upper limbs without any scar; this was supposed not to be due to amputation.

² Dupuy's words: a pair of congenital changes at the distal ends of the radius and ulna, and three on the toes.—*Diagnosis of Children*.

³ Web-fingers are, however, no doubt in most cases due to some persistence of the fetal apophysis like condition of the hand.

Separation of an intermediate segment of a limb, as when fingers are found springing from a stump of the upper arm, is probably due to pressure.

Again, *inherent* and *acquired* errors may co-exist, and would be likely to do so. A local overgrowth of the embryo might well disturb the relation between the uterus and its contents, and lead to deformity by pressure.*

Lastly, *reversion*, *atrophy*, and so on, must not be left out of sight in considering these questions, which cannot, however, be further discussed here.†

Whether double clefts, dermoid cysts of the ovary and testis, and congenital tumours of various kinds are the result of focal inclusion, parthenogenesis, or gemmation, is a question that cannot be entered upon here; it will be sufficient to say that some cases are certainly the result of 'fused' embryos—e.g. double monsters, adherent twins, and so on—while some congenital tumours are equally certainly mere errors in the closing in of the folds of the blastoderm or of the local rudiments by which certain organs are formed.‡

Supernumerary Digits are found attached in various ways; thus, a mere fleshy outgrowth with or without a nail and with no bony support, may



Fig. 155.—Double Thumb.

Fig. 156.—Interosseous Acquisition of Finger.

be attached to a more or less normal finger; at the end of a finger may be found, with two nails. In other instances a supernumerary thumb with two phalanges may spring from the joint between the 'metacarpal' bone and the first phalanx, a common joint existing for the two thumbs, or the extra one may be attached in the side of the proper one. It is sometimes not easy to make out which is the supernumerary and which the normal digit; in such cases the most useful one should, of course, be left.

In any case of supernumerary fingers the additional one should be removed in infancy, so as to allow the other as far as possible to be trained into its proper position. Where a joint is common to the two fingers care

* Deficient development of one-half of the body, with broad pelvis, has been met with (Baker, *Clin. Soc. Trans.*, 1844).

† *Club Foot* Seeley's *Lectures*, Lancet, 1859-60.

‡ "If during development the secondary fold remains soft, the complete formation is based on a single germ, and every degree of combination from two to any number may 'potentially' be formed." (Hood Norton, *Lancet*, February 21, 1886.)

* Numerical figures and references will be found in Turner's *Modifications of Development*.

must be taken not to injure the articulation and to allow it to separate, for fear of a stiff joint resulting. Supernumerary bones should be removed if they cause distortion of the foot or are likely to lead to trouble in wearing ordinary boots.

For figures and details of the different forms of polydactylism we must refer to Amussat's work on "Diseases of the Fingers and Toes."

Occasionally cases are met with where more or less of a limb is deficient, and the member ends in a pointed or truncated extremity like an amputation stump; this may occur at any point in the length of a limb. Sometimes only parts of one or more digits are deficient, sometimes the amputation has been incomplete, and a deep sulcus round the finger or limb, with often a bony expansion on the distal side of it, marks the seat of pressure. This constriction in some cases is so tight that there appears to be little left undivided except the bone, and this condition we have met with associated with talipes; the movements of the limb were, however, good, and evidently the deeper structures, though compressed, were not divided. We have also seen these constrictions associated with dimpled depressions over the knees and shoulders, and rigidity of the joints, also the result of intra-uterine pressure: in one instance there was also microcephalus. Most of the cases of intra-uterine amputation, and of these constrictions, are the result of pressure by amniotic bands or fetal adhesions, or already pointed out; but it is undoubtedly occasionally true that pressure by the umbilical cord, so gradually exerted as not to interfere with its own circulation, may produce the same effect.¹ We have not seen a case of constriction requiring any operation, though it has been suggested by Mr. Edmund Owen to pass the adjacent surfaces and unite them so as to obliterate the groove.

Nothing, of course, can be done for congenital amputation except the use of prosthetic appliances, and it is wonderful what use these patients can make of their stumps. As already pointed out, in some instances there is a distinct scar, in others a smooth unbroken cutaneous surface, and sometimes rudimentary digits remain attached in the end of a stump containing only the humerus or femur; this is rather an arrest of growth by pressure than a true amputation. So, too, sometimes the femur or humerus is congenitally very short or deficient. (Fig. 161.)

Club-hand, so called, is a rare affection, resulting from arrest of development of more or less of the radius or ulna, with consequent abduction or adduction of the hand. It is not in any sense really comparable to the ordinary forms of club-foot, and is little amenable to treatment. Sometimes,



Fig. 161.—Congenital Groove of Development of the Femur. (Limb.)

however, may be done by manipulation to remedy the deformity and possibly encourage growth of the shortened bone by friction and removal of pressure (fig. 162). Less often the hand is fixed in flexion or hyper-extension, and in these cases sometimes tenotomy may be required. Similar deformities may, of course, result from cicatricial contraction after injury. In one instance the radius was entirely deficient on both sides, and the ulna was fractured and repaired, *probably in vivo*. At the suggestion of one of our Resident Medical Officers,

Mr. J. H. Thompson, we transplanted some bone from another child into an incision between the muscles of the forearm. The wound healed perfectly, and the bone was



Fig. 162.—Down Child's hand.



Fig. 163.—'Club-foot,' in child.
(View in flexion of the radial and
ulnar with abduction of the hand.)

growing at the time of the child's death from an independent cause two or three weeks later; the position of the hand was much improved. Careful bandaging and the use of splints will do good in some cases if treatment is begun early.

Web Fingers.—Various degrees of this deformity are met with; thus there may be a mere extension of the normal web forwards to the first inter-phalangeal joint. In other instances metacarpal bones and phalanges may be fused together, or bound in very close contact throughout the whole length of the digit; occasionally the union is only at the distal ends. The deformity is usually more or less perfectly symmetrical, and often associated with a similar condition in the feet or with some other deformity.

Where there is complete bony fusion of two adjacent digits no attempt should be made to separate them; when, however, only skin and subcutaneous tissue unite the two fingers, they should be separated. Simple division of the web is of little use, since the wound granulates up from the bottom and more or less rotation occurs.

Several plans have been devised to meet this difficulty, such as applying

* This could hardly be the result of failure of the normal differentiation of the fingers in foetal life, which results from the phalanges outgrowing the web.

an elastic cord between the fingers and fastening it round the wrist after division of the web; performing the base of the web and putting a thread or wire through the orifice and allowing it to heal, and then dividing the web. Another mode consists in dividing the web and then bringing a flap of skin from the dorsum or palm across between the fingers so as to interpose a bridge of skin at the base (Norton). The best plans are the last-mentioned and that advocated by Didot, in which a dorsal flap from one finger and the web, and a palmar flap from the other finger and the palmar aspect of the web, are cut; the rest of the web is then divided, and the flaps are wrapped round the free surface of the finger to which they remain attached. In doing this operation, however, it will be found that there is not sufficient skin to cover both fingers, and one has to heal by granulation. Web toes do not require treatment.

Congenital Rigidity of Joints and Contractions. As already stated, children are sometimes born with joints, chiefly the knees, elbows, and shoulders, which are stiff or, on the other hand, unstable; and sometimes these joints are fixed in flexion, sometimes hyper-extended, or at least hyper-extensible. In such cases there are not rarely marks of pressure about the joints—depressions and adhesions of the skin. Probably the conditions determining such deformities are like those causing talipes, viz. intra-uterine pressure or malposition; thus the 'post-naturnum' sometimes seen results from the limbs being picked in hyper-extension along the ventral surface of the body (figs. 164, 165). Failure of developmental rotation accounts for others.

Diligent friction and passive movement, together with the application of splints, as the individual deformity may require, will sometimes effect great improvement; in other instances little success attends treatment.

One or more of the fingers or toes may be congenitally contracted either in flexion or extension; the contraction, often slight at first, tends to increase.

1. Wilksley, M.D. reports a good case in which there was so much rigidity that the knee bent directly forward. By the use of apparatus and treatment an almost perfect cure was obtained. *Brit. Med. Jour.* July 12, 1884; vol. lxxviii.



FIG. 164.—Joint preservation and talipes calcaneus: from direct by the late Mr. C. F. Norton.

as the child grows. Hammer-toe is a result of this condition. In some instances it has been shown that contraction of the ligaments of the interphalangeal joints is the cause of the deformity.

We have met with a non-congenital form of contraction of the osseous joints of the index and middle fingers. The skin and fascia over the structures affected just as in Dupuytren's contraction. According to Adams the 1st finger is more often affected, and the deformity is said to be markedly hereditary, and to be commonly associated with a history of 'hammer-toe'!

Stretching and simple splints, in ordinary cases, is the treatment required.



Fig. 109.—Anatomical position of child, congenital dislocation of hip-joint, and talipes equinovarus, from a case by the late Mr. C. E. Silliman.

If neglected, *rodentibus* comes to bones and fixation of the limb may result from pressure of bone. Division of the lateral ligaments, or in some cases resection of a joint or part of the shaft of a phalanx, or even amputation, may be the best treatment for hammer-toe.

'Haltera flexa,' first described by Mr. Davies Gilly, is defined as a 'progressive dislocation' in the normal range of extension of the great toe. It causes lameness, is pathologically closely allied to hammer-toe, and requires treatment by rest followed by manipulation and exercise, and in severe cases by division of the lateral ligaments or osteotomy. *Foot-ache*—'*Metatarsalgia*,' pp. 469-90. Halter's valgus and other deviations of the toe

are rarely serious in children, and are usually amenable to treatment by splints.

It must be remembered that some of these patients with distorted limbs are cases of cerebral delinquency, and for them of course little can be done.

Congenital Distortions.—In fact, of almost any joint may be met with: thus the temporo-mandibular, elbow, and wrist joints, the joints of the spine, toes, &c., have been found displaced, though such deformities are by far most frequently met with in the hip. These conditions have been variously explained: injury *in utero* or at birth, intra-uterine inflammations, contractions, pressure.

¹ Adams, *Lancet*, December 25, 1890, 1891, 1894; and Addison's Lectures, *Lancet*, August 1891.

bones, bony, and muscular lesions have all been assigned, as in club-foot, as causes of congenital dislocations. It is more probable that, as in club-foot, an excessive pressure from malposition is the most frequent cause, though not the only one. In all cases more or less deformity of the bony articular surfaces is found, and this is of the utmost importance, since it largely prevents the possibility of anything like complete reduction.

In 'congenital dislocation' of the lower jaw the condyle and glenoid cavity, as well as much of the bony framework of that side of the skull, have been found stained. Occipital-affected dislocations, both backward and forward, has been described; in the former the head is flexed, in the latter hyper-extended.

Dislocations of the clavicle in the various ages with it later life are also mentioned by Guérin.

The humerus may be displaced downwards, forwards (subcoracoid), or backwards (subspineus), with arrest of growth of muscle and bone, and deviation from the normal shape of the articular surfaces.¹ Displacements of the elbow and wrist have also been met with.² The most important of all these malformations is **Congenital Dislocation of the Hip**, since it is by far the most frequent, and sometimes seriously incapacitates the subject of it. In these cases the acetabulum is small, shallow, and may be filled with fat or 'welded over'; the head of the femur may be nearly normal or much stunted. A more or less perfect capsule may be present, and this may be thickened; or, again, a sort of interosseous ligament may exist: the ligamentum teres is atrophied, the muscles around the joint are wasted. The affection may be unilateral or more often bilateral. The femur is usually freely movable and slides up and down upon the acetabulum to an extent of sometimes two inches or more.

The affected limb or limbs are usually imperfectly developed throughout. There is always a good deal of lameness in severe cases, though we have met with slight degrees of this deformity in which the joint was not very much altered. There are marked lordosis and a peculiar 'saddling' way of walking, which is very characteristic. Usually the displacement is upwards and backwards, but it may be in almost any direction; the limbs are sometimes adducted markedly.



Fig. 442.—'Congenital Dislocation' of both Hips. Not a severe case.

¹ Dislocation of the humerus appears to be often associated with other malformations; in a case shown me by one David M. C. E. Richmond there were adequate dislocation of the shoulder and dislocation of both hips. See Chapter on Legacies.

² See Harrison's work on *Fractures and Dislocations*.

Besides the ungainliness of the walk, it is possible that the deformity of the pelvis may, as Adams suggested, be important from an electric point of view. There is little to be done for these cases, though it has been recommended that the affected limb should be supported and freed in a state of extension, and it is said that a certain amount of increased stability in the joint may result. Section of the muscles surrounding the joint, and even excision, as well as amputation of the deeper tissues and hollowing out the surface of the ilium, have been practised with the object of giving increased stability to the joint, but it is unlikely that any of these plans will gain favour. Hoffa's mode of operating has been tried in a number of cases, but published results do not encourage further attempts in this direction. Prolonged extension in bed we have found do harm rather than good, though some successful cases have been recorded. When the affection is unilateral a thick-soled boot on the short limb will support the gait, and in some cases a pelvic girdle, with pads to support and fix the end of the femur, has been service. Long walks and long standing should be avoided, but we rather recommend any operative treatment. The history of the case, the absence of pain and rigidity, and the peculiar gait distinguish the affection from hip disease. Rickety hardness sometimes closely resembles congenital dislocation, but careful examination of the relative positions of the trochanters and iliac spines will prevent a mistake. The affection is by no means rare, and we have seen many instances of it.

So-called **Congenital Dislocation of the Knee** has been already mentioned as 'joint recurvatum.' This joint is also occasionally found with partial backward or lateral displacement. If seen in quite early infancy, these deformities are fairly amenable to treatment by manipulation and massage, and we have been able to completely remedy the deformity of 'reverted knee' by these means (vide pp. 162, 164).

Besides the deformities already described, it is necessary just to mention the occurrence of cases of **Congenital Puncture of the Sternum** from non-union of the different centres of ossification, or rather non-closure of the ventral lamina, sometimes associated with scapulothoracic. Cases of deficiency of the ribs over a larger or smaller area, and lack of development of the muscles of the chest-wall and of the mammary glands, may be met with; we have seen hernia of the lung through a gap of this sort. (Vide Thompson, 'Teratology,' January 1893.)

Congenital Deficiency of one or both Clavicles or of the Scapula may also be occasionally seen. A suprascapula has been met with, attaching the scapula to the vertebra, and requiring removal (Willett and Walslow, 'Med. Clin. Trans.' 1883). Deficiency or imperfect development of the patella sometimes occurs; it is usually absent in cases of joint recurvatum. Many other abnormal conditions may occur—some deficiencies, some excesses, &c. in the common cases of supernumerary mammae, which are doubtless instances of reversion, and so on; but these cannot be discussed here. Many require no treatment; others must be dealt with on general rules. Occasionally protective shields may be required for such cases as thoracic hernia.

1 Mr. Adams (*Brit. Med. Soc.* February 1890) relates cases observing the value of prolonged extension and ligatures supporters. Vide also *Lectures on Diseases of the Hip*, Boston, 1890, and papers in the *Annals of Surgery*, 1893.

CHAPTER XXXI

DISEASES OF THE NOSE.

THE ORIFICES of the anterior nares are a favorite seat of eczema, fungus, and superficial tuberculous ulceration; other cutaneous affections and warts are also often met with upon the surface of the nose: *vide* Chapters XVII. and XXXVII.

The nasal cavity in children are exceedingly often the seat of acute or chronic catarrh, the result of cold, or extension from the pharynx. Catarrh also commonly occurs in rickets, tuberculous, or syphilitic children.

Acute Catarrh is generally simply mucous; it may, however, become purulent, or may be so from the first, especially if it is the result of inoculation, which may occur at birth or accidentally at a later period.

Chronic Nasal Catarrh is marked by discharge of mucopurulent material from the nose, swelling of the mucous membrane and of the skin of the anterior nares, with often some thickening of the upper lip from irritation; the voice is nasal, respiration is impeded, deafness is often present, the child moans, and in an infant suckling is often difficult, sometimes impossible, been obstruction to breathing through the nose. Occasionally the inflammation extends to the antrum, nasal duct, or frontal sinuses. On examining the nose the interior is seen to be red and angry-looking, often slightly excoriated; it easily bleeds, and there are frequently dried scales on its surface, while stringy mucus is apt to collect upon the lips in neglected children and give rise to anorexia. Where one nostril alone is affected, careful search must be made for one of these conditions: a foreign body, such as a button, a bit of slate pencil, or a date-stone, &c.; a mucous polypus growing from the upon of the inferior or middle turbinate bone—a somewhat rare condition in childhood; or, thirdly, a deviated nasal septum.

Chronic catarrh, from whatever cause, is apt, if neglected, to give rise to eczema from decomposition of the retained secretion, or from caries or necrosis of the bones of the fossa; where the bones are involved the latter is more common than in other cases.

Should the inflammation extend to the cartilaginous and bony septum, the nose may lose its support, by softening of these structures, and become flattened and depressed. Where the outer walls are more especially attacked, a broad thickened nose results. In most cases these deformities occur in connection with congenital syphilis rather than in tubercular or simple bone lesions. A probe will usually detect the presence of bare bone, and it must be remembered that in cases of apparently simple polypus a

patch of exposed bone will often be felt. Bleeding from the nose in these affections occurs often in small amounts, but rarely to any serious extent.

Diagnosis.—The existence of chronic nasal catarrh is obvious; its cause requires looking for, and this should be done systematically. First, if unilateral, the causes already mentioned—foreign body, deviated septum, or polypus—are to be suspected. If double, the throat should be examined for enlarged tonsils, chronic pharyngitis, and post-nasal adenoid growths. Evidence of congenital syphilis or tuberculosis may be obtained, or sometimes simply carious teeth or eczema may be the source of the trouble.

Treatment.—If the cause is local, an anæsthetic should be given, and the foreign body, post-nasal growths, &c., removed. To remove a foreign body from the nose, a simple loop of silver wire is useful, or a pair of dressing forceps, or a small scoop may be employed. Sometimes a finger passed from the mouth into the posterior nares is of service, and occasionally the nasopharynx is to push the foreign body back into the pharynx and remove it from the mouth. In one of our cases the body, a button, escaped into the pharynx while the child was under chloroform, and was found in the vomit brought up by the child on its awaking. In syphilitic and tubercular cases syringing out with warm alkaline lotions (soda bicarb. gr. xx; 3j; $\frac{3}{4}$), or in older children the nasal douche, is the most efficient means of clearing away the crusts; this should be done three or four times daily, and subsequently powdered boracic acid or tannic acid and iodoform in equal parts should be blown into the nose through a quill or insufflator, or the nasal cavity may be treated over with glycerine of tannin or lead lotion. Sometimes a spray may be substituted for the syringing after the nose is once cleared. Solution of hydrosulphate of cocaine, 2 to 10 per cent., may be used as a spray or brushed on, either before removing a foreign body or in cases of acute catarrh. Cleansings and care of the general health, with mercury or iodide of potassium, or both together, according to the child's age, are required in syphilitic cases.¹ Any sequestra should be removed as early as possible, and all foul crusts kept constantly cleared away. Cod-liver oil and iron, with the usual hygienic measures and careful clearing of the nose, together with iodoform insufflation, is the best treatment for the tubercular cases. Nitrate of silver, gr. x. ss to $\frac{1}{2}$, is sometimes used with advantage as an occasional application. In nearly all chronic cases the prognosis is somewhat uncertain, and the course of the disease tedious. Where the above-mentioned methods fail, and especially in tuberculous ulceration of the nasal mucous membrane, an anæsthetic should be given and the affected parts well scraped with a Volkmann's spoon, or cauterized with the wire cautery.

Nasal obstruction, apart from the causes just mentioned and those already detailed under Diseases of Tonsils, &c., may be due to deviation of the cartilaginous septum. This is sometimes congenital—more often it is the result of fracture of the septum, or dislocation from either the ethmoid or maxilla, or from the nasal spine of the upper jaw; or, again, it may be the result of a chronic perichondritis, following an injury, and resulting in swelling and subsequent deviation of a local patch of the septum. If the whole

¹ In later mercury alone, in children over three or four years old, is of palliative value, or, being a good result, combined with mercury, is, we find, the most successful plan.

cartilage is involved, there will be some flaring of the end of the nose; this, however, does not usually occur. Simple chronic perichondritis, causing thickening, hypertrophy of the septum, or abscess, or even ecdymatosis of the cartilage may also be met with. The treatment of deviated septum consists in forcible straightening with a pair of guarded sequentia forceps or with Adair's special instrument; and the subsequent wearing of a nasal ring, such as Walsham's or the one devised by one of the present writers, is required. In some cases removal of the projecting mass is called for: in such circumstances the mucoperichondrium should be dissected up and laid down again after removal of the cartilage. Haemorrhage, if it does not abate, is best treated by incision—so also abscess; usually in both cases incision on one side will empty the sac on both sides, since the cartilage is perforated. Deformation is best treated by the use of plugs. Lateral deviation of the nose visible externally ("crooked nose") sometimes requires the use of special appliances to be worn to correct the deformity. For an account of some cases see paper in "Medical Classics," vol. iv., 1886.

Nasal Polypi are somewhat rarely met with in childhood; they spring from the region of the middle or inferior turbinated bones as soft, grey, semi-transparent, rounded masses; occasionally they take origin higher up in the nasal cavity. Repeated removals with the use of astringents in the intervals is the treatment required.¹ The polypi should be taken away with forceps; in some cases the tendency to re-growth is so obstinate that it is necessary to take away the whole of the turbinated bone from which the growths arise.

Where there is nasal obstruction from chronic catarrh or circumscribed contraction, the use of nasal bougies or plugs smeared with any medicament desired, such as oxide of lead or iodoform ointment, is useful.

Superficial Ulceration of the mucous membrane of the nose often occurs in cases of chronic catarrh from any cause, and occasionally the ulcers are deeper and lead to perforation of the septum; this is especially likely to occur from pressure of foreign bodies. We have seen perforation of the septum occur in a child simply from picking the nose.

Chronic Dry Catarrh of the nose, unaccompanied by atrophy of the turbinated bones and their coverings, may be met with; it is often associated with scurvy. The treatment is similar to that of ordinary chronic catarrh, but, according to Sir M. Mackenzie, the use of medicated plugs of wool relieves some cases. The disease is a very intractable one; painting with glycerine is occasionally useful.

Gargophthal Malformations of the nose are rare; closure of the anterior or posterior nares, adhesions between the walls of the nasal bone, perforation of the septum, and cases of cleft or fluted nose, or even of entire deficiency of the organ, have been met with.²

Malignant Polypi of the nose and nares are occasionally seen in children; early removal is the only treatment, but speedy recurrence is to be looked for.

¹ Acid tartaric, parts (ii) equal sulphuric acid (i) twice diluted with part g. will be found a good wash for these cases of strabismus; the iodine applications mentioned under Rhinitis Capitis are, however, often sufficient. The continuous application of nitrate of silver (1 grain to a ounce) is sometimes required.

² See figs. of deformities under External Abnormalities of the Nose.

Epistaxis. occurs very frequently in children, sometimes as a result merely of cerebral congestion; the communication between the long-tailed veins and the nasal veins remaining open in early childhood; in other cases congestion from catarrh, or ulceration, injury, or foreign bodies, &c., may give rise to bleeding. Haemophilic patients frequently bleed from the nose, and epistaxis is a complication often met with in some of the scarfeveries, &c.

Usually the bleeding ceases spontaneously in a short time; if this is not so, bathing with cold water, or a little ice applied inside or over the nose, will usually stop the flow. Astringent powders or lotions, tannin, alum, &c. may be blown into the nostrils. Sometimes pressure from outside is efficient; in other cases rubbing the child nasal upright, with the arms above the head so as to expand the chest and relieve venous engorgement, will prove successful.

Occasionally the nose may require plugging.

Nasal Deformity.—Where there is destruction of the whole or part of the nose, plastic operations may be employed. These must be planned according to the individual requirements of the case. We are now in opinion that a good artificial nose is preferable to most of those obtained by plastic operations. Where, however, there is loss of only a small part of the nose, or where there is fissuring without loss of substance, attempts should be made to restore the appearance of the child by filling up the gap or elevating the depressed part. It will be found that there is great difficulty in obtaining a good permanent nose by any method, and too much should not be promised. For details of the methods of operating we must refer to numerous books on Operative Surgery.

CHAPTER XXXII

DISEASES OF THE EAR.

Diseases of the External Ear.—The auricle may be congenitally absent or cramped and distorted: for the former condition an artificial ear may be fitted, for the latter usually nothing can be done.

In cases of deficient development of the pinna the rimæ of the jaw may also be stunted—i.e. the first palatal arch and its appendages may be ill developed.

For an account of supernumerary auricles and foræ, vide p. 585.

Sometimes the ear is unduly large, and stands out persistently from the side of the head: the appearance may be improved by the use of an ear press, or in extreme cases by removal of a triangular portion of the ear and careful closure of the gap by suture, or excision of a portion of the skin and cartilage from the posterior surface of the pinna, or by suturing the ear to the skin covering the mastoid process.

The pinna is often the seat of eczema and eczéma, which require the treatment of the same affections elsewhere: eczema most commonly attacks the crease between the auricle and the side of the head, and disfigures the free edge of the ear.

Simple, lupous, or other tuberculous ulceration may also attack the ear, and we have seen the whole auricle rapidly slough away during an attack of sleeping-sore.

The orifice of the external meatus is sometimes congenitally closed: in such cases, if the tuning-fork shows the labyrinth to be healthy, a careful dissection may be made at the site of the orifice, so the meatus may be reached by incision behind the auricle and the orifice afterwards opened upon a bent probe. Nothing should be attempted until the child is old enough to have the hearing power tested, unless there is evidence of retained secretion giving rise to abscess, when an opening must be at once made.

The common affections of the **external meatus**, which in children is proportionately shallower and broader in a horizontal direction than in adults, are eczema, boils, accumulations of wax or epidermis, and the presence of foreign bodies: the first are not peculiar to children; the last is, of course, commoner in them. If the foreign body has passed beyond the orifice of the meatus, it should be removed by gently syringing, or by means of a loop of silver wire, or by a probe coated with collodion-wax or glue. No violence

¹ As in a case of Carnot's, *Paris. Soc. Trans.* vol. 19. We have had similar cases under our own care.

should be used, and it is better to leave a foreign body where it is than to push it further in or facilitate the return of troublesome symptoms by attempts at its removal. Insects, &c., in the meatus are readily killed by a drop or two of oil.

Eczema, tuberculous sores, &c., may give rise to purulent discharge from the ear, but usually such discharge comes from the middle ear. In all cases the ear should be carefully soaked up with absorbent wool and the ear examined; sometimes, however, the meatus is so swollen and the discharge so irritable that no examination can be made: under such conditions the case should be treated as one of otitis media until, either with or without anaesthesia, the ear can be examined.

The imperfect development of the tympanic bone and consequent shallowness of the meatus in children would be borne in mind; in young infants the eardrum lies in a more horizontal plane than in adults.

Inflammation of the Middle Ear may be either acute or chronic. The causes of acute otitis are catarrh of the nasopharynx, usually associated with enlarged tonsils or post-nasal adenoid growths, cold, and the exanthema, especially scarlet fever; injuries also, by poking or roughly drying out the ear with corners of towels and so on, may rupture the membrane and set up otitis media.

CASE.—Otis, T. (Child).— *Presented, Edward Leach, Esq., M.D., F.R.C.S.,* (age 9 years), admitted July 8, 1904. Always healthy till twelve months ago, when she had whooping-cough, running from nose, and deafness; worse lately. On admission, middle ear aspect; little adenoid tissue; both tonsils bulge forwards and upwards; nasal mucosa, especially backward (upper part of pharynx stuffed full of warty adenoid growths); posterior nares nearly blocked. July 24, pharynx cleared with finger, curette, and Williamson's spray; left nasal removed, blood drawn; much adenoid cleared. Mouth, good improvement. Primary otis, quite well.

Sir W. Dalrymple has pointed out that boxing the ears of children may give rise to nervous deafness without a rupture of the membrane tympani, such deafness being usually permanent and severe; or the membrane may be ruptured: in such case the rupture may heal or be followed by inflammation of the middle ear; or, lastly, acute otitis may be set up without rupture of the membrane.

In otitis the result of these affections the disease may be caused either by Eustachian obstruction, and consequent retention of secretion, or by actual extension of the inflammation along the tube. The symptoms are pain in the ear and head, deafness, and some constitutional disturbance. In adults, who cannot indicate the seat of their trouble, otitis should be suspected if there are restlessness and restlessness, with tossing about of the head without other assignable cause. If these cases are left to themselves, the membrane soon yields, and a purulent discharge escapes from the meatus, giving usually great relief; until discharge appears the condition is often overlooked in scarlet fever, where the attention is apt to be directed to other symptoms. If the membrane is examined in such cases, there will be seen all the signs of inflammation, redness and loss of lustre, and if pus is present it may perhaps be visible as a yellow discoloration of the lower part of the membrane.

Treatment.—The throat must be attended to, and antiseptic, sedative, or anæsthetic applications used, according to circumstances; next, the Eustachian tube must be kept open by Politzer's method; the inflation can be performed at the moment of the child's crying. Hot fomentations, with perhaps a leech behind and in front of the ear, and instillations of a drop of glycerine and tannin, or glycerine and carbolic acid, into the meatus, should be employed. Failing relief by these means, the membrane should be carefully incised, either horizontally or vertically, behind the handle of the malleus, and the discharge allowed to escape—gentle washing out of the ear with warm boracic lotion, and inflation of the middle ear, being also used. As soon as the acute symptoms have passed off, powdered boracic acid and iodoforn should be blown into the ear after drying it carefully with absorbent wool twice or three times daily, according to the amount of discharge.

The dangers of otitis media are manifold. First, deafness; and secondly, extension of inflammation, which may reach the mastoid antrum or the mastoid cells, perforate the roof of the tympanum, or the rotunda petromastoidæ, which is still open in infancy, and so directly reach the brain. Cerebral abscess and meningitis are not remote dangers. Or the carotid artery may be opened by ulceration and fatal bleeding ensue; or thrombosis of the lateral sinus and pyæmia may result. Extension of mischief to the temporo-mastoidary joint may occur, with stiffness of the articulation. The amount of deafness depends rather upon the injury done to the labyrinth, upon interference with the mobility of the ossicles, or upon fixation of the malleus, than upon destruction of the membrana tympani.

The dangers to life are to be met by providing free drainage for discharge and keeping the cavity aseptic as far as possible. If there is any pain, swelling, or tenderness over the mastoid process, an incision should be at once made down upon it; if no pus is reached and the symptoms are urgent, the bone must be carefully gouged away just behind and below with the trepan of the meatus until the cavity of the antrum is reached. It must be remembered that in children the mastoid cells are not well developed and vary much in size, and that the lateral sinus descends less than half an inch behind the meatus. Swelling and tenderness over the mastoid process does not always mean inflammation of the mastoid antrum or cells, but may be the result of extension superficially of inflammation from the meatus. Even if pus is not reached at the time, relief may be given and an outlet may for discharge made; but the removal of bone should be free if the symptoms are definite, and, if possible, an opening should be made through which lotion can be syringed into the external meatus. Late advice removal of the whole of the outer wall of the antrum.¹ In neglected cases extensive necrosis may occur, and the walls of the antrum, or even the greater part of the petrous bone, may come away as sequestra. It is common to find the lymphatic glands just below the ear enlarged, and they may cause much pain, or may separate and discharge through the walls of the meatus. In the early stages of glandular inflammation hot belladonna fomentations will often arrest the mischief; if suppuration occurs, the abscess should be early incised. Suppurative meningitis, if diffuse, is not amenable to treatment, but localized cerebral abscess, which may be either in the

¹ *Brit. Med. Jour.*, March 20th and 27th 1900.

temporo-sphenoidal lobe or cerebellum, should be treated by trephining the skull and opening the abscess (vide p. 467 *et seq.*)

Facial paralysis, which not uncommonly results from otitis media, is peripheral, and the result of pressure upon the nerve in the wall of the tympanum; the paralysis usually disappears on subsidence of the otitis, but may be permanent. Chronic otitis media may be due to the same causes as the above, but is often tuberculous; it may last for years, and give rise to occasional attacks of acute catarrh. Chronic otitis is always a source of danger, and should never be neglected; the tympanic cavity should be carefully cleaned by gentle syringing, and then the mucous membrane put into a healthy state by insufflation daily of the iodiform and boracic powder, or by the use of slight astringents, such as alum, gr. \frac{ss} to \mathfrak{ss} , or sulphate of zinc, gr. \frac{ss} to \mathfrak{ss} ; boracic and carbolic lotions are perhaps the most generally useful. On examination of the ear in these cases the membrane is usually almost entirely gone, and the ossicles more or less completely destroyed; the hearing power is impaired, but seldom entirely lost. The complications met with in the acute variety are also liable to occur at any time in the course of a chronic case. Small perforations of the membrane in children usually heal, but it is exceptional to meet with them.

In very chronic tubercular masses of granulation tissue, springing from the tympanic cavity, less often from the membrane or walls of the tunic, may appear, and form the commonest kind of nasal polypus; fibrous, mucous, and adenomatous polypi are much rarer. Polypi are to be treated by removal with forceps, or syringing away, and the application of some caustic, of which we prefer solid nitrate of silver fixed on a loop of wire; crystals of perchloride of iron or chromic acid may be used if preferred, and the ear should be washed out with a solution of rectified spirit as strong as can be borne without pain (usually 1 in 4 to 1-2 can be employed). Boracic and tannic acid and iodiform insufflations should be used between times. It is often necessary to remove these polypi several times before they cease growing. All abscesses forming about the ear must be opened and well drained, and the general health, as well as the condition of the throat and nose, carefully looked after. Emmetian catheters require an anæsthetic in children, and should only be used when Poltzer's method fails.

The general routine method, then, of treating otitis media suppurativa may be given thus. (1) Dry out the ear with absorbent wool. (2) Examine with a speculum, and through this puff a powder of equal parts of iodiform and boracic acid, once, twice, or three times daily, according to the amount of discharge. (3) Inflate the ear by Politzer's method once daily. (4) Wash for, and open early, any abscess or glandular abscess. (5) Protect from cold, and take care of the general health. (6) Never neglect the head catarrh. (7) See that the throat and nasopharynx are healthy.

¹ Where impure pusulent matter becomes daily the fluids should be changed in the ear with more frequent intervals.

² We prefer a simple speculum and the use of an equal cotton-tipped nozzle, but Dr. Brown's "otoscope" may be used.

³ A cotton plug of absorbent wool should be put into the meatus and changed twice or three times daily as soon, according to the amount of discharge.

It must be remembered that pain in the ear may be a result of various teeth, cervical adenitis, or any source of pressure upon the nerves supplying the auricle or meatus, as well as of ear disease.¹

Affections of the Labyrinth in children may be either congenital, or the result of injury, or of extension from otitis media, or of congenital syphilis. The latter form usually comes on about the seventh or twelfth year, increases rapidly, affects one ear first, and leads to severe or total deafness; it is rarely curable, though mercury and iodide of potassium should be tried. If the case comes under treatment in an early stage, there is some hope of recovery. Deafness in children should be seen to at once, and care should be taken, in those in whom restoration of hearing cannot be complete, to make them read and speak aloud to prevent the tendency to become mutters. Deaf-mutes should be taught the 'oral method.'

Intracranial Abscess.—Should there be evidence of intracranial abscess, as shown by fever, vomiting, diarrhoea, pain in the side of the head, convulsions, aguish, hemiplegia, more or less loss of consciousness, and perhaps optic neuritis, the ear should be examined and well cleaned out, so as to avoid any further retention of pus in the tympanum; a flap of soft parts should then be raised up by a curved incision, exposing the temporal bone above and behind the ear; a circle of bone should then be gouged away, having its centre opposite the posterior superior quadrant of the meatus, and from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. from the meatus, according to the age of the patient.² Having removed the bone, if no sign of abscess appears, the dura mater should be incised and the brain punctured first directly inwards, then forwards and upwards, and finally backwards, so as to tap any abscess situated either in the cerebrum or cerebellum; if pus is found, the opening should be enlarged, and the abscess drained and treated on general principles. The mastoid antrum and cells, if not previously cleared out, should be dealt with at the same time. (Vide also p. 467.) Barker points out that a single rigor, followed by subnormal temperature, slow pulse, and 'doggish, but perfect, cerebration,' may be met with in cerebral abscess. There appears to be no certain means of distinguishing temporo-sphenoidal from cerebellar abscess, but in the latter the pain is usually occipital, and there is remission of the head; the amount of paralysis in either case is inconstant. Temporo-sphenoidal abscess is about three times as common as cerebellar according to Barker, who summarises the whole question in a valuable paper in the *Lancet* for June 13, 1887. He also believes that abscess in the brain is much rarer than meningitis or tubercular suppuration.

Not very long ago we had under the care of our colleague Dr. Hutton and ourselves, a boy eleven years old, suffering from double otitis after small-pox. On admission there was discharge from both ears, with pain in the left, and in the left temple. Shortly after entering the hospital he had a succession of rigors. The ears were full of thick discharge, and each

¹ Vide Hutton's *Ear and Nose*.

² Barker gives $\frac{1}{2}$ in. above and $\frac{1}{2}$ in. behind the vertex of the Gargy meatus for subdural abscess over the end of the tympanum, and $\frac{1}{2}$ in. directly behind the meatus for tubercular abscess in the groove of the lateral sinus. By enlarging the opening upwards and backwards, and then puncturing the dura matter, avoiding the lateral sinus, any abscess in the brain would probably be tapped.

contained a small polypus. The ears were cleaned out, the polypoid granulations removed, and the acute symptoms disappeared. There was no marked trouble. A week later the boy became drowsy, with a subnormal temperature: there was no paralysis, no spasm, except possibly of the muscles of the left side of the face, but this was probably rather passive of the right side. Slight cloudiness of the left optic disc was found; there was no apparent tenderness. The next day a circle of bone was removed from above and behind the meatus, the dura mater opened, and the brain explored systematically, but no abscess was found in the temporo-sphenoidal region. A second flap of skin was then raised upwards from the occiput, and a small aperture made in the skull: a trocar was then passed downwards through the foramen into the cerebellum, and effluvia pur escaped; the cannula was left in, but the boy died, apparently of shock, six hours later. Some examination of the head we should advise in such cases: the removal of a circle of bone immediately above the external auditory meatus, at a distance from it varying from $\frac{1}{2}$ in. to 1 in., according to age; the dura mater should then be stripped back until the roof of the tympanum is exposed, and any pus being there evacuated. Next, the dura mater should be incised and the brain explored, first directly forwards, in the posterior part of the temporo-sphenoidal lobe, and, failing this, backwards, upwards, and downwards, and finally forwards. Either a temporo-sphenoidal or cerebellar abscess would probably be thus reached. If, however, the symptoms are fairly definite and no abscess is found in this way, the skull should be opened midway between the superior and inferior curved lines of the occipital bone, and the cerebellum explored. It is rarely reached in this position.

It should be remembered that a cerebellar abscess may be latent—or, may exist and give rise to few or almost no symptoms—and yet may cause sudden death.

In the above case there were no definite symptoms to point to cerebellar rather than to temporo-sphenoidal abscess, and it was only, taking the history, that, feeling strongly that an abscess existed somewhere, we sought it in the cerebellum. (Vide also *CEREBRAL ABSCESS*.)

In cases of tuberculous sinus we have been in the habit of freely scraping out the middle ear with a Volkman's spoon, removing all cheesy bone and granulation tissue with or without a mastoid incision, according to the extent of the disease. The scraping should be thorough, and should be repeated if necessary.

When symptoms of septic absorption and thrombosis of the internal jugular and internal jugular vein exist, the vein should be exposed and ligatured, and then together with the sinus laid open and cleaned out. Similar constitutional symptoms with orbital swelling and proptosis would suggest thrombosis of the cavernous sinus, which occasionally occurs, and might possibly be reached by operation through the orbit, though we are not aware that this has been hitherto attempted. (Vide p. 485.)

NOTE.—In examining the tympanic cavity post mortem, it should be remembered that the presence of a perforation fluid in the middle ear or within it remains, and apparently rather the result of the changes that take place after the entry of air into the tympanic cavity than pathological.

CHAPTER XXXIII

TUMOUR GROWTH IN CHILDHOOD

Tumour Growth in Childhood.—As might be expected in a rapidly growing organism, the connective-tissue group of tumours is that almost exclusively met with in children. Sarcoma, myosarcoma, endothelioma, and osteoma are the common forms of new growth, and these are usually in an embryonic and therefore unstable and rapidly growing form. Soft (unossified) sarcoma is occasionally met with, it is rare especially in the eye, kidney, and testicle; but it is probable that most of the so-called sarcomata are really sarcomata.¹ Our colleague, Dr. Hutton, had under his care a child with an enormous tumour of the kidney, which proved to be a columnar epithelioma.²

Sarcomata are not rare in children; they are commonly of the small round-celled or round varieties, are most often seen as peritoneal growths, and often follow injuries. They are met with in connection with the liver, the skull, and the long bones, most commonly grow rapidly, early become granulated, and are speedily fatal; or have met with rapidly growing sarcoma as a sequel of acute peritonitis.

The eye and the skin are not rarely the seat of sarcoma; we have seen a melanotic spindle-celled growth in the skin of the dorsum of the foot. The kidney is occasionally the subject of congenital sarcoma (vide Chapter on Diseases of the Kidney).



Fig. 105.—Sarcoma of the lower Jaw and Eye, had in a child aged 19 months.

¹ These are also common sites for sarcoma in childhood.

² *Proc. Ed. Soc.*

³ As in the following case, figured above (fig. 105) :—

Sarcoma of Eye and Jaw, &c.—Walter W., age 1 year 7 months, admitted July 28, 1886. At birth, in the left eye it was noticed that the pupil was white; some months ago

Where sarcomata occur in the limbs, early amputation is the only means; in the case of renal growths the balance of evidence is against any operation. Testicular tumours should be removed as soon as they are recognised, and growths in other situations must be treated as the individual case may require.

We have met with a *Neurofibroma* only once in a child, and the case is of sufficient interest to be worth recording in detail.

Neurofibroma of Pubertal Period.—*Child A.*—Aged 5½, age 4½ years, admitted May 3, 1899. Heretofore healthy. Three years ago first complaint of pain in the right ankle and called

with a limp. Has been getting worse slowly, and the ankle has become more swollen. On admission there was much tenderness along the inner border of the ankle, extending for about 4½ inches up the leg. There is swelling and some heat over the painful area, which seemed to correspond to the position of the tibia posterior and first tarsal ligaments. The case was thought to be one of rheumatism, and the child was sent out in a plaster of Paris cast on May 20. Re-admitted November 1, Condition unchanged; tooth painful (lower). November 25, the case was treated as rheumatism and no more made out; the swelling is no longer evident, when a few, pale, tubercled lesions were found connected with the junction of the arm; the growth on the posterior tibia remained fairly large; it reached from the middle of the leg to nearly the middle of the shaft of the tibia, and was about the size of half-a-dozen fingers. The arm was increasingly swollen and was drawn up. The whole mass and fingers were removed, about a volume of the latter being taken away. No further wound was injured, but there was troublesome bleeding from some small ones. She did not bear the operation well. For some days she had high fever, and the appearance of the opposite limb.



Fig. 10.—Tumourness of Osseal Type and Fingers.

wound healed well, but somewhat slowly. On the 27th the whole side of the foot began to the end of the toes was completely anæsthetic, as well as almost the whole of the posterior surface of the

the eye began to swell: three weeks ago the right half of the lower jaw began to swell considerably and to grow rapidly in size. No more lesions. On admission, well nourished. The left eyelid was enlarged and protruded; it was irregular in shape and reddened; the conjunctiva vascular. The lower part of the right side of face (much enlarged), the arm on the surface, which was tubercled; swelling involved whole thickness of lower end of tibia, projecting outwardly and over mouth, which could not be touched. Teeth displaced and loose; no eruption; no disease elsewhere. August 1, swelling increasing rapidly, not much pain, losing teeth. Discharged August 12, and died at home a few weeks later.

infection. The sides of the foot, the ball of the great toe, and on a line representing the axis of the second, third, and fourth toes, together with the whole of these plantar surfaces, were greatly anæsthetic. Sensation elsewhere normal. The calf muscles somewhat wasted. In January 1886 she was practically in no discharge, but could walk a mile and move the feet freely without pain. Nutrition of feet good. Monoscopically the lamina was a cystiformous. Nerves could be traced to some extent in it and then became beaded and lost. March 23, 1886, quite well; no return of sensation; feet warm; gait good; walks well; no pain or tenderness.

Of the more innocent growths the **Echordiomata** are the most common; they are usually multiple, occur on the fingers, and may be congenital; they tend to grow with more or less rapidity, and if they cause inconvenience may require amputation of one or more fingers. Removal of the growth alone is rarely satisfactory, since it has been shown that the tumor is very often central in origin, as in the following instance:—



Fig. 1001. Multiple Echordiomata of the Fingers.

Multiple Echordiomata of the Fingers.—HAROLD M., age 2 years 9 months; admitted January 26, 1884. When five months old swellings were noticed on the inner and middle fingers of the left hand; these have gradually increased, and give rise to much pain if injured; at other times they are painless. On admission, a thin, healthy boy. Several cartilaginous masses are growing from all the fingers of both hands; the swelling on the middle finger is the most prominent, the largest is on the flexor aspect of the left middle finger; this finger cannot be flexed. The fingers are large and distended, with some lateral deflection of the second and third fingers of the right hand. The second, third, and middle fingers were amputated at the sesamoid-phalanx joint, and the flaps were sutured up with catgut (Evans). A section of the finger showed a cartilaginous nodule, dense as a small walnut, growing from the proximal end and from the central part of the epiphyseal end of the second phalanx. The flexor tendon was stretched over the nodule. A smaller mass springing from the distal end of the same phalanx. The second nerve bled. The other fingers were not touched, as they gave rise to no great inconvenience. The osseous structures were similarly altered (Figs. 1001, 1002).

Another case is shown in Fig. 109. **Osteomata** are usually sessile, composed of cancellous tissue capped with soft cartilaginous or hyaline hyaline tissue; they most frequently spring from the neighbourhood of an epiphyseal line, may be multiple, and are occasionally hereditary. These growths may require removal on account of their interference with the movements of a joint, or of pain; if chiselled or sawn through at the base, they do not recur. We have most often seen them at the upper end of the humerus, as in the case quoted.

History.—Daniel E. L., age 12 years 6 months, admitted January 8, 1884. Tumour first noticed six weeks ago; has grown slightly since; no more known. The tumour is massive as large as a good-sized infant's head; one foot (anterior) part of the humerus is visible below the axilla; the swelling runs inferiorly, known by usual anastomosis on January 17, the surface was cartilaginous, the deeper part composed of cancellous tissue. Would bleed on January 22.



FIG. 109.—Hypertrophy of the Soft Tissues of the Neck, associated with Myeloid Cancer. Mr. W. W. Child's case. The tumour is extending into the Artery.

Besides the growths already mentioned, there is the large group of **Congenital Fibrous and Cystic Tumours**. The former may occur in any part, the latter are said to be limited to the trunk and head; we have, however, removed a multilocular cystic growth from the back of the thigh in a child. Cystic hygroma of the axilla is not very uncommon; it usually extends up into the neck. The cystic tumours may be divided into several classes. A large proportion are really cavernous lymphangiomas (lymphæcyst); such are hygroma, hydrocyst of the neck (a multilocular hygroma), the tumour mentioned above as removed from the thigh, and many others. In the second group are those cystic tumours resulting from degeneration of a blood vessel; in these the fluid may be clear, or more or less stained by admixture of blood pigment. The third group includes cystic formations by degeneration



FIG. 110.—Congenital Fibrous Cyst of the Back.

tion in fibrous or teratogenous growths; and the last includes dermoid cysts, the result of involution or 'disinvolution' of blastoderm.¹

These 'dermoid' cysts may be met with in the course of any of the lines of union of the embryo, e.g. along the median ventral and dorsal lines of the trunk in the face, head, palate, nose, &c. These cysts are due to closing in of the tissues over a portion of epiblast; hence the cyst wall is composed of more or less perfectly formed skin, with hairs, sebaceous glands, &c.; lying in the cavity of the cyst will be found sebaceous matter and hairs, and epidermic scales. Perhaps the commonest sites for these tumours are the outer angle of the orbit (orbital fissure), the inner angle (lacrimal fissure), and the median ventral line. In the axilla they may result from inclusion of skin between the tubercles by fusion of which the axilla is formed. They are sometimes met with in the middle line of the nose, and cause much disfigurement by the growth of hair from their interior; in this position they must be due, as pointed out by Huxley Burton, to some irregular laying down of the skin, since there is no line of fusion in the development of the embryo at this spot. Probably the growth of the nasal bones and lateral cartilages causes some inversion of the skin. The growth of hair seen upon the nose in later life suggests a possible similarity between the two conditions.

Dermoid cysts differ from acquired sebaceous cysts in that they are congenital, that they lie deeper than the ordinary wen, being in the subcutaneous or even in the submuscular tissues, and in the case of the skull they may cause partial or complete absorption of the underlying bone. The skin over a dermoid cyst is usually of normal appearance and of normal thickness, not thinned and showing dilated capillaries, as is often the case in sebaceous cysts. In sebaceous cysts the aperture of the gland is often visible as a black spot; no such mark is seen in a dermoid tumour. Should the dermoid cysts grow and become mighty, they should be excised, but it must be remembered that their removal may be dangerous on account of their deep relations, and that, as they are lined with more or less perfect skin, complete removal is required, and it is not sufficient to lay open and scrape the cyst wall.



Fig. 171.—Dermoid Cyst of Orbit.

¹ The relation of congenital 'displacements' to subsequent tumour growth is most, at present, to be discussed here; probably only a small number of cases are to be thus accounted for (see Columbus; also E. B. Loomis on the *Orig. of Sarcoma*, 1862, and Huxley Burton's *Lectures on Evolution in Pathology*, Brit. Med. Jour., 1885).

Mr. Hild. Storer, is his lecture delivered at the Royal College of Surgeons, *vascular dermoid tumours* as (1) Supra-orbital dermoids; (2) Talar dermoids; (3) Ocular dermoids.

The first class applies to the lines of union of the bones, or are a result of union, a sort of subcutaneous grafting of dermal tissue.

Talar-dermoids arise in connection with "choroid vessels" associated with the primary alimentary canal. They may exist as "dermoid spots," "dermoid fungoids," or as "dermoid dermoids," or "congenital melanomas." "The first two varieties do not differ from acquired dermoids except that they are more complex." Mr. Storer calls these talar dermoids because of their histological resemblance to the talar bone. "The present study recognises the existence of three types of dermoid tumours of the eye,



Fig. 2710.—Dermoid Cyst of the Forehead. Mr. Hilditch's case.

(1) tumours immediately on the thyroid body; (2) are frequently associated with striped or unstriped muscle tissue; and (3) are usually congenital." The most typical specimens occur in the neighbourhood of the nostrils, in the tongue, and in the neck.¹

After further details, for which we must refer to the *British Medical Journal*, March 2, 1886, whence the above extracts are taken, Mr. Storer concludes his most interesting account of these tumour growths by remarking: "It is an interesting fact that the oculo-laryngeal ducts existing in the embryo often anomalous, namely, the oculo-laryngeal, oculo-tracheal, oculo-gastric, oculo-intestinal canal, oculo-lingual duct, and the duct of the yolk sac, should all have direct relation with the alimentary canal, and even be directly associated with dermoids, often of considerable complexity, and with a peculiar form of tumour, dermoid in structure with the thyroid body." Quite recently we have met with a case of an infant, a twin three days old, who was the subject of a large melanodermoid

¹ *See also Marshall, Jour. Anat. and Phys.* vol. xxv.

masses growing from beneath the cornea, and forming a somewhat peduncled mass hanging from the pericorneum. The eye was threatened, and stood the size of the child's head. A day or two after admission the eye burst, and gave out to about half a pint of clear yellow fluid—perfectly serous. We removed the collapsed eye by excision, and found a fine child's growing eye in the orbit for about 1½ inch. The child did well, and was sent out with the wound neatly healed in March 1886. Sections of the wall of the eye showed a distinctly effused lining, with a single layer of connective-tissue between parallel cells.

Also chapter on MALFORMATIONS OF THE DIGESTIVE APPARATUS.

An important group of tumors in childhood is formed by the **fatty growths** often met with. There may be simple general obesity or hypertrophy of fat, a condition often met with in our experience in association with malformations such as club-foot, spina bifida, giant foot, &c.¹ Jacob²



Fig. 174.—Dissected Case of the Enlarged Tumor. A track is seen growing in through part of the tumor. (Prof. Young's case.)

who has collected many of the cases on record of hypertrophy of the extremities, attributes the condition to intra-uterine venous congestion³ in early fetal life; if, however, this occurs before the first half of intra-uterine life, during which no fat is said to be formed, asymmetrical tissue is developed: for the later stages, *faty tissue*.

Lipoma may occur in any part of the body: it is, however, rarely met with in the head. Congenital lipomata are often not encapsuled; they are sometimes associated with naevus, as in fig. 60 (naevus lipomatodes), or, as

¹ The cervical fatty growths are sometimes also associated in this connection.

² *Archives of Pediatrics*, February 1887. Jacob's list contains no less than 100 different pathological conditions. Also *Blaud-Sutton, Brit. Med. Jour.*, vol. L. 1886, p. 477.

³ Every attention to the lymph circulation.

in one case of Jacob's, with spina bifida. Congenital sarral tumours are uncommonly solitary, as in one or two of our own cases; but three, and indeed congenital lipomata elsewhere, are by no means always just two.



FIG. 100. Congenital Macrolipoma of the Breast. The tumour was removed, and the child did well. We have lately seen a second similar case.

growths; fibrosis, bony, or cartilaginous material may be mixed up with the fat, as well as nervous, muscular tissue, &c.; these more complex tumours belong to the teratomatous class rather than to the ordinary lipomata.

When occurring in the foot congenital lipomata form one of the varieties of so-called "giant foot," of which fig. 175 is a specimen; in some of these cases the growth is encircled; in others it is diffuse, and after incomplete removal it shows a tendency to recurrence. In these cases of giant feet, which are usually unilateral, the rate of growth is variable, and all the constituents of the foot are overgrown in some cases, while in others the bones are enlarged, the vessels, muscles, and nerves being normal. (See also chapters on Nævus, p. 324, for an account of the lymphatic form of "giant foot.")

Fatty tumours of doubtful congenital origin are sometimes met with, and may be the seat of neoplastic change, as in the appended case.

¹ *Ann. Burin, de l'Acad. de medecine*, 1877.

² *Ann. Anatom. et Physiol. Suppl.*, 1881; *Harvard, Civ. Serv. Trans.*, 1884; *Blakader's Arch. of Pathology*, Oct. 1884; *Hutchinson and Kohnsberg, Die mykxomatösen Tumoren*, Hamburg, 1885.

CASE.—*Congenital (?) Myxopoma of Thigh.*—William M., age 2 years; admitted November 2, 1885. Child began to walk last January, but was weak and soon tired; had a severe fall at that time. Four months ago a swelling was first noticed on the back of the left thigh; it has gradually increased in size, but has never been painful. Has been nursing infants for nearly definitely lately. No sores about the legs. On admission, a very robust child. In the middle of the back of the left thigh, a soft movable swelling, not tender, not well defined, and indistinctly fluctuating. The swelling is about the size of a large walnut or larger. November 3, an incision was made over the swelling between the hamstrings; it was found to project on the inner side of the great saphenous, and was, with some dissection, divided out from its deeper attachments to the superficial layer of peroneus; it extended from the upper border of the popliteal space upwards for about 4 inches. The white growth was removed; it was fairly well encapsulated, soft, and gelatinous. Microscopically it proved to be a myxopoma. On November 10 all stitches were removed and the wound was almost healed. Best room.



Fig. 177.—Congenital Cystic Tumour of the Thigh. Mr. Halsey's case.

Congenital Congenital Tumours occur most frequently about the nasal and femoral regions; their origin is obscure, and has been accounted for on the view of included foetuses, gemination, or inclusion of a portion of the outer layer of blastoderm, at the time of closure of the foetal lamina.¹ The tumours are often cystic, and may contain masses of fat, cartilage, bone, and skin elements. They vary in size, and may attain great dimensions; their

¹ Mr. Philip Sisson divides these tumours into four classes: 1. Nasal cystic tumours; 2. Tumours originating in the postnasal gut; 3. Cystic tumours originating in the embryonic vesicle; 4. Epithelial tumours.—*Encyclopædia of Medicine*, Vol. IV, February 15, 1885.

rate of growth usually corresponds with that of the child; they may become alienated from nutrition. Such tumours give rise to trouble by their weight and bulk, and their interference with movement.¹

Case of enlarged Sternal Tumour.—Eliza Ann T., age 4 years; admitted February 2, 1885. Always a delicate child; never so weak as attack of measles first in two years. The tumour has gradually increased to such an extent as to hinder her. She has had no ill-effects frequently after meals; cannot retain her urine, but has no incontinence of feces;



Fig. 113. Enlarged Sternal Tumour with Talipes.

sleeps badly; is so weak and open; no action or coördination; temperature normal; with a little fever. She became steadily worse, and died on the 27th with evidence of meningitis. The highest temperature was 99° F.

Post-mortem.—On opening the head, no signs of fluid escaped; the surface of the brain was congested, but otherwise normal; there was some rusting together along the Sylvian fissure, but no other abnormal appearance. Spinal cord, mass of fluid and congestion at the end of the column and in the sacral canal shown it. The cord ended in a

small head and sometimes a flattened point. On admission, a delicate child. Over the lower lumbar and upper sacral regions it is a soft, pulpy tumour, about the size of a small orange; the skin is natural color; there is no tenderness on pressure, and the walking is not hampered. There is loss of power in both legs; she still can draw them up to feel, but cannot support herself upon them. February 13, the tumour was explored with a needle, but no fluid was found; a straight incision was then made over the swelling, and the skin reflected, exposing a mass of fat. On dissecting this carefully away a small tumour the size of a filbert was exposed; this evidently contained fluid and could be seen to pulsate; it clearly was connected with the thorax; this was left unopened, and the legs were dressed away from it. The wound was dressed and healed; operation uneventful. On making a section of the growth a small portion of cartilage was found in its centre. February 22, dressed, about half an ounce of blood-stained serum escaped; child quieted down, otherwise well; no convulsions or pain; tube removed. 18th, was sick twice yesterday and twice several times in the night, screaming, with sick again yesterday; no more vomiting; has very quiet 18th, dressed; a quantity of serum collected beneath the skin, so tube was put in again; has been very restless the last two days; sick once in the night; sleep well; is so weak and open; no action or coördination; temperature normal; with a little fever. She became steadily worse, and died on the 27th with evidence of meningitis. The highest temperature was 99° F.

¹ Vide also *Text*, by James Hardie, F.R.C.S., *Lancet*, May 2, 1885. Also the subject of meningitis is a valuable to enter here, but for ready reference, among other works, to *Finsen's Microbiology in Medicine*.

hemorrhagic which spread may cover the tumour. Small portions of the tumour extended downwards into the sacrum. The laminae were imperfect at the root of the tumour; the central canal of the cord was dilated below the mid-dorsal region, and the left canal of grey matter had disappeared, leaving a hollow space. This was evidently a combination of spina bifida, syringomyelia, and a compound tumour of vertebra and sac. The operation was undertaken with the view of possibly relieving the cord of pressure and so removing the paraplegia, but there is much risk of meningitis in this case.

As these growths are usually median in position or nearly so, they resemble spina bifida: hence they have been called 'false spina bifida' (vide p. 328); they may have attachments within the spinal canal or plexus.

Any congenital tumour of the vault of the skull or over the spine should be looked upon with suspicion, as likely to have intimate relations with the cranial or spinal cavities. The appearance of the skin, the mobility of the masses, its rediability, and the effects of pressure, &c., are the points to be looked to (vide Chap. XXV.). It is sometimes impossible to diagnose neuroma from other soft growths; the presence of cutaneous stunts or of nerve clowbers; the effects of straining or crying; the possibility of partly emptying the tumour; and its peculiar spongy feel, must be taken into account (vide Chap. XVII.).

Treatment.—Congenital lipomata, if large, rapidly growing, painful, or inconvenient, should be excised. The congenital sacral tumours, unless for some very good reason, should be left alone—there is much risk of injury to the spinal contents, as seen in the case just related.

Cystic growths may be treated by tapping, injection, stress, incision, or excision: none of these modes are free from danger, and the last is sometimes impossible from the extent and connections of the mass. In large unilocular deep-seated cysts, such as 'hydrocoele of the neck,' tapping, followed by injection with Morton's solution if the cyst refills, is the best plan; if suppuration occurs, free incision and drainage must be employed. The multilocular cysts are often best treated by setons, small threads being inserted and the process repeated if necessary. In the numerous lymphatic naevi, much lymph may drain away if the growth is cut off, just as bleeding occurs from a blood naevus, and there is much risk of septic infection or exhaustion: hence these growths should be removed rarely, if at all.

In the case of giant feet the fatty variety has a tendency to steadily grow, and though pressure may slightly retard it, we have not found it succeed as a means of treatment. Ligature of the anterior and posterior tibial arteries in the following case gave a good result for a time, but after a year of two the growth continued. In such cases the choice is between leaving the case alone and amputation: the latter should only be done when the



Fig. 170.—Section of Congenital Sacral Tumour. A points to the spinal canal; B to the body of a vertebra; C to a mass of softening cartilage in the tumour.

1 For further details vide L. Smith: *Lancet*, 1886, vol. 128, and *Robert, Guy's Hospital Reports*, 1886.

crippling from the presence of the growth is greater than would result from the mutilation.

Case.—Pn. Giger. Epithelioma Parotidis.—Randa C., aged 5 months, admitted June 25, 1884. Family history unimportant. At birth it was noticed that the left foot was distinctly larger than the right; since birth time it has steadily grown. There has been no pain, and the child's health has been unimpaired. (Thanks to the kindness of Mr. Winton, of Salem, we were able to examine this case almost from the first.) On admission, a large, knobby, solid, the left foot much enlarged, chiefly the dorsum and inner side; was not inflamed, skin normal, disfigurement causing it to be the only one of a few feet visible on the left. Measurements:

At root of toe	5½ in.	Right foot at 18 months	—
At middle of foot	7½ in.	—	4½
Across foot and toes	8 in.	—	5½
Around ankle	7 in.	—	5½
Middle of calf	7½ in.	—	7½

Healed pressure was fully tried for a long time, and to advantage without apparently diminishing the size of the growth. The temperature of the two feet did not apparently differ, and the child could kick the feet about, though awkwardly. On July 20, posterior (dorsal) artery was ligatured in the middle of the leg by the usual method, a rubber ligature being employed; the wound was very small, and its pulsations felt; a drainage tube was used, operation antiseptic; all went on well. On the 25th the measurements were as before, except the one at the root of the foot, which was 4½ in.; wound almost healed. July 22, the anterior artery was ligatured distally, not divided between the ligatures; the wound was healed in the ligatures. After first dressing, wound abraded; no drainage was used; measurements as on 25th, except middle of foot 4 in.; less. With Martin's benzoin application, the margins of the foot seem to have been indurated with August 4 measurements.—Foot at root 5½ in.; middle of foot 2½ in.; across heel and foot, 8 in.; around ankle, 7½ in.; middle of calf, 7½ in. February 1885, the foot is getting smaller in all dimensions. Subsequently the growth remained stationary for a while and then increased.

Lymphoma, Lymphadenoma, Lymphosarcoma. is characterized not only in the shape of large masses of glands in the neck (fig. 180) or elsewhere, which slowly grow and give trouble from their size, unsightliness, and pressure effects (with Hodgkin's Disease), as well as ultimately cancer-death.

Removal of such masses of glands is usually of only temporary value; it is seldom that all can be got away, and recurrence often takes place in a short time. Section of such a tumour shows a pinkish-grey lymphoid tissue with no cancer foci.

The following was a characteristic case:—

Case.—Lymphoma of Neck.—John T., age 15 years 4 months, admitted November 20, 1884. Family history good, except that the mother had dysenteria beneath the jaw while pregnant with this child; boy himself went very hearty, but had. On health; two months ago a swelling appeared beneath the lower jaw on the left side; this grew slowly till the last three months, when it has increased rapidly; for three weeks has had pain. On admission, in the left posterior triangle is a large globular tumour consisting of isolated lymphatic masses; the swelling extends from a inch below the jaw to 1½ inch below the clavicle, which it overlies; it is 2½ inches in transverse diameter; some of it projects beneath the trapezius, and resting mainly, with nearly to the middle line of the neck; the skin is normal over it, and it is not hard to the vertex; no marked glands

¹ Cystic lymphomata are sometimes met with, and these growths have been found in the system, among other places.

are enlarged everywhere, though a few slightly enlarged glands can be felt on the lower gum; none dilated over area of left lung; left jugul. slightly swollen and less movable than right. On November 25 the gland masses were removed, weighing 4 oz.; most of the glands shelled out easily, some were adherent. The external jugular vein was tied and divided; at times when traction was made upon the vessels (about) during the operation the pulse was much accelerated; the carotid vessels and carotid (parathyroid) ganglia were exposed. He bore the operation well and not too little blood. Operation antiseptic, with oxygen pressure; recovery untroubled; anastomosis was left off on December 6, and he was discharged with a small superficial wound. February 1895, the boy has been better since the operation, but new masses of glands are already beginning to enlarge, though at and after the operation some glands had died.

Another case is shown in fig. 116. It is not at all uncommon to find cases in which certain of the glands have broken down and discharged, while in other respects the conditions resemble lymphoma rather than tuberculous. We have accounted for these cases by supposing that tuberculous and Hodgkin's disease have coexisted. We have seen lymphoma also appear in a third the subject of hip disease. Variation in the size of the swellings, associated with fever, but subsiding without suppuration, is also often seen.



Fig. 116.—Lymphoma of the Neck.

Multilocular Cystic Growths of the Jaws arise from epithelial ingrowth from the surface of the gum, which afterwards become shut off and develop cysts; they may be congenital or occur in infancy. Besides these, two other forms of cyst are found associated with the teeth (dentary cysts): (1) Cysts originating in connection with the tooth follicles—*follicular*, or, if they contain teeth, *dentigerous* cysts; (2) *Periosteal* cysts, originating beneath the periosteum of the jaw.

Dentigerous cysts arise from mal-placed or mal-developed teeth, and (say) occur at any part of the jaws; they contain clear, serous or glassy, white or coloured fluid, rarely pus. Most often they are associated with the permanent, sometimes with the milk teeth. Eggshell cracking, the presence of fluid, and suppression of a tooth are the common indications of the nature of these swellings. (Eve, 'Brit. Med. Jour.', Jan. 6, 1885; Heath, 'Lancet,' 1887.)

For further details on the question of tumours we must refer to the general text-books.

CHAPTER XXXIV

DISEASES OF THE THYROID AND THYMUS

Acute Enlargement of the Thyroid.—A slight enlargement with tenderness of the thyroid gland is not uncommon, but any acute enlargement, the result of inflammation, is very rare. A typical case of this kind is recorded by Dr. T. Barlow,¹ in a boy of three years. The symptoms at first consisted in pain in the neck on movement, feverishness and slight enlargement of the thyroid gland. Later the swelling considerably increased; the temperature varied from 100° to 103° F.; there was some difficulty in swallowing, but no marked dyspnoea. In four or five days the swelling began to subside; he finally made a good recovery.

Chronic Enlargement.—Goitre.—Simple or cystic enlargement of the thyroid is sometimes met with in children, most commonly in the inhabitants of certain hilly districts such as Derbyshire; it is however met with in cases among town-bred children, both with and without a family history of goitre.

In the case here figured half the gland was removed; it consisted of a mass about the size of a small orange; in it were many cysts, the larger of which contained reddish yellow fluid. The child did perfectly well, but died some months later of scarlet fever; the other half of the gland had not appreciably altered after the operation.

We have been three times called upon to perform tracheostomy in young people for urgent dyspnoea, the result of pressure of an enlarged thyroid gland; in two cases the patients were young adults, the third was an ill-developed, idiotic child, in whom there was enlargement of the tonsils, with post-nasal vegetation; these had been dealt with once with marked improvement, but on the second occasion sudden dyspnoea, evidently due to pressure of the enlarged thyroid, was brought on by any attempt at examination, and on administering chloroform the breathing stopped; tracheostomy was performed, and the child did fairly well for a day or two, but died of bronchitis on the 3d or 4th day. The operation under such circumstances may be of extreme difficulty alike from the presence of the large mass of gland, from the engorgement of the vessels, and from the altered shape of the trachea, which is compressed laterally. A specially long tube is required to reach down below the constricted part of the windpipe. There is no doubt that in any case where attacks of dyspnoea, 'thyroid asthma,' have occurred, either removal of part of the gland or division of the isthmus should be performed.

¹ On a Case of Acute Enlargement of the Thyroid Gland in a Child, by Dr. T. Barlow. *Clin. Soc. Trans.* vol. vii.

in an interval between the attacks.* In simple cases of goitre the treatment is the same as for adults.

We have divided the thyroid isthmus in a young person of sixteen, in whom acute attacks of almost fatal dyspnoea had more than once occurred. The trachea was much fattened laterally ('scabbard trachea'). Three weeks after operation the gland had resumed nearly its normal size. In another case the operation was done during an attack, and the patient died a few hours later from rapid oedema of the lungs. In another, part of the gland was removed and tracheotomy performed; the patient recovered, though in cases where tracheotomy is necessary the danger to life is much increased.

It is not very uncommon to see children in whom the thyroid is slightly enlarged and sometimes painful and tender, but in whom there is no very great deformity and no cystic development. These cases of 'simple bronchitis' may be met with at any age, but are perhaps most common about puberty. Under treatment with iodine or arsenic internally, and weak red iodide of mercury ointment, cautiously used, externally, the gland usually returns to its natural size. Iron is required if there is anaemia.

The thyroid gland is usually absent in cases of myxoedema or 'sporadic cretinism'; in any case of wasting or disease of the thyroid the possibility of myxoedema must be borne in mind.

Thyroid gland.—The thyroid body or gland reaches its greatest size at two years of age, after which it dwindles, and by puberty is in most cases reduced to a mere vestige. At birth it measures some 2 in. in length and perhaps 1½ in. in breadth, and weighs about ½ oz. At two years of age it weighs from ½ to 2 oz. It is situated behind the upper pole of the sternum, reaching as low down as the fourth costal space; it lies partly on the pericardium, the aortic arch, and large vessels.

But little can be said concerning the diseases of the thyroid. Some authors have attributed laryngismus and spasm of the glottis to enlargement of the thyroid and a consequent pressure on the nerves or trachea itself. It is very doubtful if laryngismus is due in any way to hypertrophy of the thyroid, but cases in which there was evident pressure on the trachea by an enlarged thyroid have been recorded by Goodhart, Jacobé, and Baginsky. Sudden death from spasm of the glottis is not uncommon during the first two or three years of life, and this has in some cases been attributed to the presence of an enlarged thyroid (Pott). We are by no means convinced of this. It is common to find small cysts on first sight looking like



Fig. 111.—Cystic Bronchitis in a Child.

abscesses scattered through the substance of the thymus; these have been attributed to syphilis. Jacobi has noted an excessive quantity of connective tissue in the thymus of syphilitic children. He has also observed tuberculosis of the thymus in cases of general tuberculosis. Denise has recorded a case in which caseous masses were found. The thymus when it becomes tubercular probably does so from contact with caseous mediastinal lymph glands, as in case related at p. 695. In some recorded instances it appears that sarcoma has originated in the thymus.

CHAPTER XXXV

DISEASES OF THE SKIN

DURING intra-uterine life the fetus is surrounded by the liquor amnii, and the skin is in consequence in a soft and sodden condition at birth. After birth it is subjected to the drying action of the air, it receives a larger blood supply than before birth, and the glands which it contains become functionally active. It is now exposed to various forms of irritation, such as the contact of the urine, faeces, and various excretions, and the friction which takes place during washing. It is hardly surprising to find that under these new conditions the skin is often injured, especially when we bear in mind the delicate nature of the horny layer of the epidermis. In consequence of the rapid growth which is taking place, there is necessarily a continual building up of the tissues of the skin to keep pace with body-growth, and any interference with the infant's digestion or assimilation of its food is exceedingly likely to interfere with the nutrition of the skin. This is seen in various conditions of wasting during infancy; the skin becomes rough and harsh, and the slightest irritation from the urine or faeces, or friction at the flexures of the joints, gives rise to an erythema, eczema, or to excoriations.

Reflex inflammations are more common during infancy than in later life, a transference of inflammation readily taking place from one part to another, or an irritation present in one place may give rise to an inflammatory lesion at a distance. In this way we find blotches or scaly spots about the mouth and face of children who are suffering from dyspepsia, or gastric catarrh, or herpetic patches about the nose or mouth in those suffering from pneumonia or bronchial catarrh. Urticaria or erythematous blotches may be the result of indigestible food in the stomach, or the pressure of a tooth upon the gum, or the presence of acari burrowing beneath the skin.

Eruptions of the skin are exceedingly common during infancy and childhood, and we find eczema, intertrigo, urticaria, and lichen among the most frequent ailments at this period.

ECZEMA.

Eczema during infancy, while often passing amenable to treatment, is exceedingly apt to relapse, and in aggravated cases it forms one of the most troublesome complaints with which the practitioner has to deal. Probably most can call to mind cases of eczema in infants a few months old which have improved for a while, then relapsed again and again, and for which numerous ointments, lotions, powders, and medicines have been tried in vain. While the majority of these cases get well at the end of the first year

is approached, or only relapse occasionally, in many cases the eczema continues to give trouble for years, or even for life.

The causes of eczema in infants are various, and, indeed, her title is known for certain about many of them. In some cases, especially in the local eczemas, there are irritants at work, such as scabies, pediculæ, and the fretting produced by napkins constantly wet with urine or feces. There cannot be a doubt that there is a close relation between the condition of the skin and the alimentary canal. It is interesting to note that if a healthy infant gets an attack of dyspepsia or diarrhea, its muscles become flabby, there is some wasting, and the nutrition of the skin is lowered; and now the contact of urine or soiled napkins sets up an irritative erythema or eczema, the irritation of the soiled napkins being powerless to excite an eczematous, until the nutrition of the skin is interfered with by faulty assimilation. One of the commonest internal causes of eczema in infants and young children is a faulty condition of the alimentary canal; probably, in some instances, the eczema is due to a mal-assimilation or insufficiency of food, and in consequence the nutrition of the skin suffers. Eczemas are usually worse during the cold east winds of spring.

In what class of children is eczema the most common? The answer must be that eczema may be found in children of every type and of every social grade. In the first place, it must be said that eczema is by no means uncommon in infants and children who are apparently in perfect health; and breast-fed infants suffer as well as artificially fed infants. We have frequently noted in hospital that children admitted for some other disease, and who are quite free from any skin trouble, develop eczema as they become fat and well. In these cases there is a strong presumption that over-feeding may have something to do with the eczema; it is certainly true that very fat children are often eczematous, and it is very possible that strong, healthy children with large appetites may habitually be overfed, and the system seek relief, as it were, in an acute or chronic discharge from the skin. Perhaps in some of these cases there is a history of eczema in the parents.

On the other hand, as already remarked, dyspeptic children, and those who are badly or poorly fed, also suffer from eczema.

The so-called stunted children are exceedingly likely to suffer from eczema, especially of the impetiginous type. The scalp, face, and backs of the ears are most likely to be affected; there is much crusting of a semi-purulent fluid, which dries and forms yellow crusts. The lymphatic glands are apt to become enlarged, and subcutaneous abscesses to form.

It is a popular notion that much of the eczemas of infancy are due to teething, and that a chronic eczema is always worse when a tooth is being cut. Mothers often look forward to the last tooth being cut, as they believe that then the child will be free from eczema. In all this we think there is a great deal of exaggeration, but it is easy to understand that a swollen and tender gum may give rise to a good deal of crying, and some feverishness. And so any eczema, especially affecting the face, may be aggravated.

Vaccination is frequently blamed by the parents of eczematous children; it is certain that a local eczema may arise at the seat of the vesicles, and an impetigo be started elsewhere in consequence of scratching; but we do not think that vaccination gives rise to a general eczema.

What part do micro-organisms play in producing eczema? It is quite certain that many cocci may be found in every eczema, but it hardly can be said that they are the cause of eczema in the same sense that the tubercle bacilli are the cause of lupus or phthisis. Given a papular itching eczema, then scratching removes the cuticle and inoculates the broken skin with cocci, which find a congenial soil in which to flourish. Much of the chronic inflammation which follows is doubtless the result of the growth of the cocci thus inoculated. Eczema may be self-inoculated, like true impetigo, by scratching.

A tendency to eczema is hereditary.

Symptoms and Course.—The commonest places for eczema in infants and young children (local irritants excluded) are the forehead, cheeks, scalp, and backs of the ears. The limbs, especially the distaves of the joints and backs of the hands, are often attacked. The usual form is *eczema vesiculosum*; in weakly and scrofulous children the peculiar variety, *E. pustulosum* or *impetiginodes*, is the most common. The former mostly begins with patches of redness, the inflamed patch quickly becoming the seat of numerous papules; in less severe cases the papules may make their appearance in crops on apparently normal skin. In the worst cases the itching is intense, and the skin of the forehead or cheeks is hot, red, and oedematous. The papules quickly become vesicular and burst, or perhaps more often the inflamed skin begins to ooze without distinct vesicles being formed. A free discharge from the skin usually gives relief. The skin continues to weep, perhaps for some days, and probably also the eczematous patch is extending, covering the whole forehead and affecting the cheeks, so that at this period all stages of the affection may be seen. In one place there may be redness only, in other places eczematized and weeping skin; at another place the discharge has dried, forming crusts with raw, tender skin beneath; where the eczema is nearly well the skin is thickened and the cutis desquamating. The skin of the thighs, flexures of the groin and knees, the arms and back, are very likely to become affected, and as the eczema heals in one place it is very likely to break out in another. Sooner or later the eczema passes into the subacute or chronic stage; the skin is more or less red and indurated, there is less oozing from the surface, while there is a tendency to form crusts and for free desquamation to take place from the skin. This desquamation or scurfiness is particularly noticed on the scalp.

In some cases the eczema is more of the erythematous type. The child goes to bed at night, and when warm in bed the face and forehead flush up, the skin becoming red, shiny, and hot; the itching and tingling is intense, so that the child scratches and almost tears itself in its restlessness and discomfort, while sleep is out of the question. In the course of an hour or two the congested vessels are relieved by a serous discharge through the perhaps already damaged skin, and the inflammatory stage is succeeded by the oozing and crusting stage. The raw and tender skin left after the discharge more or less recovers and dries up, and then there is another inflammatory attack and the process is repeated.

In weakly and scrofulous children the eczema is of a less acute type; there is less redness, burning, and itching, and a greater tendency to pus formation than when eczema occurs in strong and healthy children. The scalp

and face are mostly affected: in these places much crusting takes place, the crusts being formed of dried pus, and on raising these more or less prurient fluid escapes. In the early stages pustules are usually present. In the worst cases the whole scalp is a mass of thick crusts, abscesses form in the scalp, glandular abscesses are present in the cervical glands, and perhaps 'cold abscesses' in various places throughout the body. In dispensary practice an eczema protrusion of the back part of the scalp is almost certainly the result of pediculæ.

All forms of eczema in infants and young children are apt to relapse, fresh attacks coming on before the skin has entirely recovered from the effects of the last attack, and the old place is soon as bad as ever. The tendency is for the attacks to involve the same places time after time where the skin has been injured or has 'contracted a bad habit.' Often, however, while healing in one place it breaks out in another. The younger the infant, the more troublesome is the eczema; the older it grows, the less likely is it to relapse.

The eczema, or perhaps more properly erythema, caused by the contact of wet napkins, or by two surfaces of skin coming in contact (*impetigo*), are exceedingly common in dispensary practice; with ordinary care they never occur in healthy children, but in infants suffering from intestinal catarrh or diarrhoea, where the napkins are constantly soaked with the excretions, a certain amount of soreness may be difficult to avoid. The skin is usually first red, the erythematous eruptions spreading from the arms and genitals; the horny layers of the skin become detached, leaving superficial excoriations, from which oozes and perhaps blood may come.

Eczema in older children does not differ from eczema in adults. Any part of the body may be affected—the face, neck, or limbs, and especially the flexures of the joints. A salivary or chronic conjunctivitis is commonly associated with eczema of the face. The skin rapidly becomes red and inflamed, with a dry, rough surface, which readily cracks, making painful sores. The itching is usually severe, and the affected part is constantly fretted and irritated by the scratching which goes on.

Children who suffer from eczema are usually constipated.

Complications.—Children who suffer from eczema in some cases suffer also from bronchial asthma; in some cases the two diseases are co-existent, in other cases they alternate; there is no constant rule as far as we have been able to determine. Eczematous children frequently also suffer from gastro-intestinal catarrh. This is only another way of saying that there are children who are specially prone to catarrh of the bronchial tubes, catarrh of the stomach and bowels, and also to a catarrhal inflammation of the external surfaces of the body. We have already remarked that eczema and impetigo may co-exist in the same subject, and so also may scabies.

Treatment.—The most scrupulous care must be taken to keep the healthy infant's skin clean, especially those parts which come in contact with the soiled napkins. A daily bath should be given from the first week, but a prolonged immersion must be avoided as likely to macerate and soften the cuticle too much. A good curd soap free from excess of alkali should be used,* and soft water in preference to hard. Some starch powder, such as

* Unna's 'own baby' soap or 'Vaseline' soap makes a good soap for infants.

finely ground rice or maize powder, with 20 per cent. of boric acid, should be applied after careful drying.

If the parts about the genitals become red or excoriated, attention must at once be directed to the state of the infant's digestive organs, to see if gastric and intestinal digestion is in a normal state, or if there is diarrhoea; and it will probably be found that something is wrong here. The affected parts must be kept clean, as little friction as possible being used, and this good, or rice boiled in milk, being used instead of soap; or the parts may be cleaned with a piece of absorbent cotton-wool dipped in camellia oil. (Lime water and linseed oil, equal parts.) After carefully drying, boric acid powder, or oxide of zinc and starch (1-3), kaolin, or finely prepared siliceous earth, may be used to dust on. Where there is constant diarrhoea the ordinary napkin may be dispensed with, and pads made of absorbent cotton or wood-wool used instead, as they more readily absorb the faeces and urine. Urine's 'powder bags' are sometimes useful; these consist in bags made of soft, fine muslin, and filled with some drying powder, as zinc and starch, or Taylor's cream, and quilted, to prevent the powder from gravitating to one end. These bags may be made ready and used as required; their value consists in keeping the parts dased by the powder, which escapes through the pores of the linen or muslin.

The dietetic treatment of general eczema is often difficult, as it may be by no means clear that anything is wrong with the digestive organs. If the child is being nursed at the breast, great care should be exercised by the mother as regards her diet: beer, tea, coffee, salt meats or greasy dishes, are best avoided, or taken only in moderate quantities, while milk, fish, fresh meat, and vegetables may be taken freely. The infant, if vigorous and full-blooded, is perhaps taking too much breast-milk, and the amount of milk taken should be lessened. Possibly the breast-milk taken may be poor in quality—containing an excess of sugar, while deficient in protein and fat—the infant is flabby, poorly nourished, and suffers in consequence from *inoperto* or *inertitigo*; in such cases some form of artificial food must be given in addition to the breast-milk. In artificially reared children the content of diet is of great importance: numerous infants being brought up on cow's milk are frequently constipated and pass large quantities of undigested curd in their stools. In such cases Mellin's food, Benger's, or Savory and Moore's, may agree better than cow's milk and water. In older children, especially if there is an excess of fat, starchy and saccharine foods should be avoided, and the diet confined as much as possible to milk, cream, eggs, broth, and well-seasoned meat, and green vegetables.

The medicinal treatment must be directed to overcoming the constipation if often present, and exciting the action of the liver; small doses of mercury, castor-oil, or rhubarb and soda may be prescribed. (F. 30 or 31.)

Small doses of Rhusin or Hargadi water are often successful.

Of other internal remedies in the acute stages, alkalis, such as the citrate or bicarbonate of potash, with sodium, are frequently useful. Effervescent citrate of potash and lithia is useful both in acting on the bowels and kidneys. Castor-oil salts, taken before breakfast in warm water several times a week, may be prescribed in older children. Arsenic is rarely, if ever, of use in the early stages of infantile eczema; indeed, we have seen cases which

were made distinctly worse by it. In older children in the chronic stages, when there is a disposition to excessive desquamation, it is usually beneficial. In the chronic impetiginous eczemas of scrofulous children cod-liver oil and the iodides may be prescribed with great advantage. Cod-liver oil and arsenic may be given, or arsenic can be added to some ready-made cod-liver oil emulsion. (F. 32.)

In the management of local remedies much depends upon how the application is used, and much time and trouble may be well bestowed in showing the friends of patients how to apply the dressings, and, what is by no means unapt, to keep them in position. Merely smearing on an ointment or dabbing on a lotion may be an entirely valueless proceeding; however, the newly formed crust is very easily injured. The ointment or lotion requires to be kept in constant contact with the part if it is to be of much use. In infants and young children some method will have to be adopted to prevent scratching; mittens must be placed on the hands, and in some cases it may be necessary to secure the arms by means of bandages.

For application locally the range of remedies is very wide, and various combinations have been called into requisition in the way of lotions, liniments, and ointments. As a rule, in all acute eczemas, where there is much excoriation of the skin, or thin, newly formed skin present, much washing or rough handling should be avoided. On the other hand, in chronic cases, where the skin is thick, scaly, or infiltrated, baths are of great service in removing the scales and softening the skin. In all eczemas, however, a certain amount of cleansing is necessary to remove the remains of the old treatment and crusts; this can usually be done by gently applying some alcohol oil—or camellia oil answers very well—ordinary soap being best avoided in acute cases.

In all acute or subacute eczemas soothing remedies are required, and must be persevered in as long as there is an irritable condition of the skin and free discharge. The most troublesome eczemas in infancy are those of the face. In these, when the skin flushes up and is hot and angry during the evening exacerbations, and the infant sleepless and restless from the burning and itching of the skin, hot poppy-head or opium fomentations often give relief. Perhaps more often cooling applications are the most grateful; these may consist of camellia oil with 2 per cent of methyl or calcium salicylate. (F. 33-34, 35.)

Any of these lotions may be carefully dabbed on and allowed to dry, to be followed by a soothing ointment, or pieces of lint may be soaked in the liniment and kept continuously applied by means of a gauze bandage. The ointments most suitable for the face in acute or subacute condition are those whose basis consists of cold cream or the dry, aqueous resin of the United States Pharmacopœia, such as F. 36. This ointment must be spread on lint and kept continuously applied, being changed twice a day and reapplied.

When the eczema has passed into the scaly stage, and there is no large amount of discharge from the skin, more stimulating ointments may be used and the face kept continuously bound up to exclude the air. There should be a daily cleansing with camellia oil to remove the excess of ointment and the accumulated scales, and this ointment (F. 37) may be applied on lint. Lassar's and Lill's ointment are useful, and form a protective covering to the

scaly formed skin, but they are difficult to remove if allowed to cake on to any extent. (F. 38, 39.)

In impetigo, where the discharge is more or less purulent and much scrubbing takes place, the scabs should be removed by position or the application of carbolic oil, and some diluted mercurial ointment applied (F. 40, 41)—or an ointment consisting of five or ten grs. of iodoforn in simple ointment may be used.

Eczema affecting the scalp must be treated in a similar manner to that of the face, except that, as a rule, more stimulating applications may be applied. In the weeping and irritable stage caron oil or the calamine liniment (F. 53) or zinc and cold cream may be applied on lint or rags, and a nightcap worn by the child to protect the parts and prevent the infant from scratching. The hair must be kept short and the scalp cleansed every morning with some mild soap and warm water; or this gravel may be used. In the more chronic stages, especially in neglected cases, the crusts must be removed by oiling and poulticing, and some diluted white precipitate ointment or other mild mercurial ointment applied. Lassar's or Fife's paste (F. 38, 39) may be used, being put on thickly, thus dispensing with any lint; the crusts and mass of ointment must be removed daily or every few days. Eczema of the scalp, the result of pediculi, should be treated by poulticing, cutting the hair, and the continuous application of white precipitate ointment.

In the chronic general eczema of older children, especially where the skin is rough and coarse, and there is much infiltration, and the flexures of the joints are affected, baths and stimulating liniments, followed by some soothing protective ointment, usually answer best. Soft soap, the pure green variety, may be rubbed over the parts on a wetted flannel for a minute or two so as to soften the skin; it is then washed off in a warm bath, the child dried, and some strips of lint coated with zinc and lead ointment applied. This plan answers well in hospital, but the application of the soft soap causes smarting, and in private practice the child's friends are apt to think it makes the eczema worse and fail to persevere. Instead of the soft soap the parts may be sponged with lead and carbolic lotion (F. 42) every evening for a few minutes, the old ointment having been cleared off, to be followed by simple zinc or lead ointment.

In acute general eczema, where large surfaces of the body are affected, Swinburn's applied on rag or lint should be used, and the parts firmly bandaged with gauze bandages so that the application may be kept in constant contact with the skin. When there is much discharge and the skin inflamed and tender, it is sometimes best simply to powder on some finely ground boric acid and surround the limb with absorbent wool firmly bandaged on; or strips of lint may be saturated with caron oil; calamine liniment (F. 53) or glycerine plumb sulfacet. (1-10) may be used. In a later stage, when the skin is thickened and scaly, with but little or no discharge, more stimulating applications are necessary; ointments containing mercury, tar, zinc, or lead are usually prescribed (A. 42). The ointment should be of tolerably firm consistence, so as not to smear too readily and run into the lint.

For general eczema Pick and Ussis have employed glycerine jelly medicated with zinc and other ingredients, painted over the skin after mixing into a liquid. The glycerine jelly is dispersed in a tin or jar, which

can be used in hot water till liquefied, and it is then applied to the skin by means of a brush. The parts are then covered by a thin layer of absorbent wool; large surfaces of skin can be covered in this way. This application is inevitable if there is much discharge from the skin, as the oozing quickly dissolves away the gelatine. We have found in cases in which we have used these applications that the surface of the application, unless well covered with cotton wool, adheres to the clothes of the patient, and is easily detached. Unna's formulae are F. 44, 45.

When large surfaces are involved, as face and trunk and limbs, we prefer to use camellia oil as a dressing, or to powder with borax acid, or perfumace is covering large areas with gelatine paints.

In local eczemas, especially those about the nose, back of the ears, and flexures of the joints, Unna's salve plasters or salve ointments are very convenient and efficacious. Pieces of these can be cut with the scissors to any shape, and when placed over the patch of eczema can be readily held in position by a light bandage. The zinc and red oxide of tin or zinc salve ointment and tar and lead are the most useful.

The older writers generally uttered a note of warning against too rapidly curing a chronic or a general eczema, implying there was danger in 'driving it in.' This is indicated by those modern writers who look upon eczema as a local parasitic disease to be cured entirely by local parasiticide remedies. Now we think there may be a risk in the case of a full-blooded, robust infant or child, if the discharge from a more or less general eczema suddenly ceases, and such eczemas are apt to heal in one place and rapidly break out in another. We have twice seen a high temperature, convulsions, and death take place in fat infants who were admitted to hospital for a general eczema, and who were treated with zinc glycerine jelly, painted over a large surface. Whether in these cases it was *febril due to greasier due* we were unable to say.

Impetigo contagiosa.—This eruption is characterised by the formation of crops of vesicles of various sizes, which become converted into pustules. The pustules dry up or become ruptured, leaving a grumous-yellow thick scale. The eruption is most common about the face, especially round the mouth; it may also occur about the neck and hands. In some cases there is marked febrile disturbance before the vesicles appear. When the patient is seen for the first time, after having been affected for several days or a week, but few vesicles may be present, and only scales and crusts visible on the face and back of the neck. The disease, as its name implies, is contagious, being transferred by means of the nails from one part of the body to another, and from one child to another in a similar way. The attack may be acute or chronic, and the constitutional disturbance severe. It occurs in cachectic children and is rarely seen except in hospital practice. There is a close resemblance between impetigo contagiosa and some forms of eczema. Indeed we should say clinically there is no sharp line of demarcation between them. The treatment consists in removing the scale by oiling or paring, and applying dilute white precipitate ointment or lin. Cod liver oil should be given internally.

Occasionally another form of pustular eruption is seen in children, which differs from the ordinary impetigo contagiosa in that it is far more inveterate and gives rise to ulcers beneath the crusts which form. *Ulcering* has called

attention to such a form which he describes 'as distinguished from [] contagious by its not being contagious, by its being a pustule from the first, formed deeper in the cutis, and rounded instead of flat.' (Dukeing, quoted by Crocker.) We have seen cases which answer more or less to this description, but they have certainly been also contagious, and so presumably may be spoken of as contagious. In one of our cases, a boy of three years, the rash when first seen suggested small-pox. He was covered with pustules more or less flattened, and apparently isolated, on the face, scalp, trunk, and extremities. The pustules were surrounded by a red zone, and in places the pustules had been converted into thick scabs, under which there was deep ulceration. There was history of measles a month before. He was admitted to hospital, but in spite of treatment fresh pustules formed. These pustules were due to inoculation; they gradually dried up, leaving large round scabs, in some cases an inch in diameter, and surrounded by a red areola. It was necessary several times to scrape the scabs and soft material away from the sores beneath the scabs under an anæsthetic. He was in hospital for three months, and went out well, but with large scars. We have seen several similar though milder cases. The child was an epileptic, and the rash appeared to be worse when taking bromide. Was it a bromide rash? In the other cases resembling this coming under our notice no bromide had been taken.

Seborrhœa.—Seborrhœa is a 'functional disorder of the sebaceous glands, producing increase of the secretion, which forms an oily, waxy, or scaly accumulation on the surface' (Crocker.)

The most familiar example of this disorder is seen in dispensary practice in infants who are badly looked after and rarely washed; in such there is often an accumulation of a dirty yellow material over the anterior fontanelle, which can be scraped off with a blunt instrument. A certain amount of eczema may be present. What has been termed dry seborrhœa is not uncommon in the scalp of older children; it may occur also on the face as well as on the trunk and limbs; the scalp is dry and covered with small scales or scurf, which fly out when the head is combed or brushed. Care must be taken not to mistake diffused ringworm of the scalp for simple seborrhœa.

Treatment.—The excessive sebaceous secretion on the scalp of infants can usually be removed by gentle friction with a piece of flannel dipped in sweet olive or almond oil, following this up with washing with soap and water; this process may want repeating once or twice, and care must be taken to keep the child's head well washed. If there is a tendency to excessive secretion, a little *arg. hydrarg. os. dat.* (5 grs per cent in vaseline) or *ung. benzoe* (5*ss* ad *ij*) benzoated hard should be applied. For dry scaly patches on the face an ointment consisting of precipitated sulphur in cold cream (5*ss* ad *ij*) may be used.

Erythematous Eruptions.—The term 'erythema' is applied to those eruptions which consist in a redness or congestion of a more or less extended portion of skin, as well as to other eruptions, where there is not only a congestion, but an actual exudation from the cutaneous vessels, as in erythema nodosum.

A simple erythema of congested portion of skin occurs under various conditions: it may be the result of some external irritation, such as the contact of foetid napkins; the application of various irritants, such as mustard,

chrysemia, arsenic; or the bites of insects. An erythema sometimes precedes the eruption of the specific fevers: this occurs at times in small-pox, chicken-pox, varicella; and it accompanies other febrile disorders, which are not usually accompanied by a rash, as diphtheria, cholera, and septicæmia. An erythematous redness is often present when there is a high temperature, as in pneumonia and other febrile disorders. An **idiopathic erythema** or **roseola** is not uncommon in infants and young children, mostly as the result of some intestinal irritation, possibly also due to the irritation of the gum caused by dentition. It is more or less patchy in its distribution, occurring on the forehead, face, trunk, or limbs; there may be no marked constitutional disturbance, and the patches of redness may be the first symptom. In other cases there may be several degrees of fever, restlessness, and perhaps vomiting. The eruption is mostly fugitive, disappearing in a few hours to 24 hours. Other patches may appear as the first outbreak.

Erythema Scarlatiniforme.—Is a typical 'scarlet fever rash' ever present in any non-scarlatinal case? It is difficult to answer this question dogmatically, but it may certainly be said that in any case when there is a diffuse, well-marked, pustuliform rash, remaining visible for at least 24 hours, the disease is almost certainly scarlet fever or rubella. It is certain, however, some erythematous or mucosous rashes do closely resemble scarlet fever, and, as they are attended not infrequently with some constitutional disturbance and fever, the difficulty in diagnosis may be very great.

Some children are especially liable to mucosous rashes resembling scarlet fever, as the result of indigestion or some other source of irritation: a mucosous rash is also apt to occur in septic conditions, such as in an erysipela, or wherever pus is shut up in a cavity.

The constitutional disturbance in these cases is generally slight: the temperature may reach 101° or 102° F., the tongue may be slightly coated, but the child feels usually quite well, and his appetite is normal. The rash may very closely resemble mild scarlet fever: it is, however, as far as our experience goes, never so intense as it is in a typical or well-marked case of scarlet fever; moreover, in some part of the body it is almost sure to be patchy and unlike scarlet fever. The distinction between the mucosous and a scarlet fever rash may be difficult or impossible if one part of the body only happens to be seen, but the difficulty usually disappears if a careful examination of the whole body be made, as in some places, especially the face and trunk, the roseola is patchy, the patches having a sharp outline. Crocker speaks of a mucosous rash lasting two to six days, and followed by a more or less copious desquamation. We have never seen such a case, and should be extremely suspicious of scarlet fever in such cases. In our experience, an erythematous or mucosous rash, while it may closely resemble a scarlet fever eruption, is more fugitive, and rarely lasts more than twenty-four or forty-eight hours, and is not followed by desquamation. In the majority of cases the presence or absence of a tonsillitis will decide the diagnosis.

A mucosous rash may follow the taking of certain drugs, more especially belladonna, opium, and salicylic acid.

Erythema Perfor. **Chilblains.**—Children with slow circulations, especially the so-called sthenics, are very apt to suffer from chilblains. The frost-

the spots are the toes, heel, and fingers; they begin with redness and intense itching, or stinging, coming on towards evening, or when the patient is warm. The skin is smooth, livid, and shiny, and ulceration may take place if it is subjected to much friction. Children subject to skilisms should wear warm woollen stockings and well-fitting boots with broad toes and thick soles, and should take much exercise. In the early stages the affected parts may be painted with equal parts of tr. iodi and lin. acmisi, or lin. saponis co. with an equal quantity of lin. belladonnæ. A mild emollient ointment also answers well (capaci ʒss, almond oil ʒij, linolein ʒij), rubbed in with a piece of flannel. The ointment with ung. hydrag. or ung. iuri, or ung. picis liq., in varying proportion according to the stimulating effect desired, may be applied.

Erythema Multiforme is mostly seen during early life in association with rheumatism, or in rheumatic subjects; whatever importance it possesses is derived from this association. The outbreak of this form of erythema is always suggestive of the rheumatic state, and an examination of the heart for endocarditis should always be made. The most common form consists in red papules surrounded by more or less congested skin. In association with the papules there may be flat raised patches surrounded by a zone of redness (erythema marginatum). Sometimes the eruption becomes purpuric, and bullæ or vesicles may form.

Erythema Nodosum has apparently a close relationship to the erythema just described, though the constitutional disturbance is often much greater. Prior to the appearance of the nodos there may be rheumatic pains and fever, the temperature perhaps reaching 103° or 104°, and the child is apparently quite ill (see fig. 37). The eruption appears most copiously over the limbs, but the trunk, especially on the extensor surfaces, or any part of the body, may be attacked; it appears as node-like, tender, and swellings of various sizes, accompanied by a burning or itching sensation. The patches come out two or three at a time in various parts of the body. At first rose-red in colour, they then assume a darker red colour, and as they disappear become of a yellow colour like a fading louse.

Not much treatment is required for erythema multiforme or nodosum. A light milk diet, a mild aperient with some saline, with salicylate of soda if rheumatism is suspected. Locally, lead lotion with some tr. opii or liq. carbolic detergens may be used.

Urticaria is characterised by the sudden appearance of elevated blotches or wheals, at first red in colour, afterwards becoming white and surrounded by a zone of redness. They are attended by much burning and itching. The blotches usually disappear in the course of a few hours, but most frequently there are successive crops. In some cases a certain amount of oedema is produced by urticaria; we have seen children with oedema of the eyes and backs of the hands following nettle-rash. There is usually some gastro-intestinal disturbance. Urticaria is sometimes, especially in infants, a distressing and troublesome complaint, the intense itching making the child restless, and entirely preventing sleep. Urticaria is the result, in the large majority of instances, of some irritation in the alimentary canal, less often upon clothing; sometimes it is due to the bites of insects or snakes. Worms are not an uncommon cause in young children; fruits

of various kinds, especially strawberries, fish, smagres, scale meat, and milk, or any kind of food which disagrees, may act as a cause.

The most troublesome form of urticaria is that variety known as **urticaria papulosa** or **lichen urticatus**. This is a very intractable affection and may last for many months or even years. When seen in dispendary position it is very apt to be mistaken for scabies, as the rash consists of numerous papules; many are often scratched over as the result of scratchings about the body, limbs, hands, and feet. In the worst cases the whole body is covered with itching papules, in some places, perhaps, becoming pustular, making the resemblance to scabies a very close one, but no 'harrows' can be discovered. The eruption begins as small wheals, which become papules, fresh ones coming out every night in crops when the child goes to bed. Its rest is broken, and its health may be seriously interfered with. It is most common during the period of the first dentition, and the tendency is to mostly disappears at three or four years of age. In the milder cases there is a succession of papules, some of which are accompanied by a small vesicle, which is quickly broken by scratching. After two or three days the vesicle ceases to make its appearance, to return, perhaps, in a few weeks. Generally speaking, urticaria is more common in summer than winter.

In some children fleas and other insects will produce vesicles as well as papules, and give rise to more or less constitutional disturbance.

Treatment.—An aperient should be given, calomel or rhubarb and soda being the best. Santoin and calomel may be given if worms are suspected. A saline such as citrate of potash or bicarbonate of potassium may be ordered. Locally, sponging the wheals with lead and tar lotion (such as F. 42) is perhaps the best application, or each wheal may be rubbed with menthol or painted with collodion. Sulphur baths (sulphuret of potassium, $\frac{1}{4}$ oz a bath) are useful in the chronic varieties.

Lichen Scrofulosus 'is characterised by very small inflammatory papules of a red colour, fading to that of the normal skin, disposed in groups or circles, and occurring mainly in scrofulous subjects.' (Coulter.)

This form of lichen is not common in our experience, but it is easily overlooked, inasmuch as it is unattended with any great inconvenience to the patient; they may make no complaint, and it is only discovered accidentally. The important points in the diagnosis consist in the absence of itching and the presence of caisson lymph glands or other well-marked evidence of scrofula. The papules are small, and of a bright red colour at first, gradually changing to dull red, disorganising, and finally leaving a brown stain. They may be present on the trunk or limbs. Their course is very chronic, fresh papules appearing as the old ones fade, so that the patient may not be entirely free for months or years.

Psoriasis.—This affection is common in children over three years of age, but is seldom so severe or so intractable as it often is in adults. It is perhaps even more liable to recur in children than in adults. The symptoms are so similar during childhood to those seen in after-life that no detailed description is necessary. The treatment we usually adopt is to give cod-liver-oil, beginning with two minims doses and gradually increasing it. Warm baths, with the moderate use of green soft soap to remove the scales, applying some fatty or mercurial ointment. In hospital patients we have used

Asper's solution of chrysarobia with great success. The solution is applied to the spots twice a week, the patient wearing old linen to avoid damage. (F. 44, 47.)

Pityriasis Rubra.—We have occasionally seen this disease in children, but it is comparatively rare. The best marked case we have seen was in a girl of eight years; twice over she has been in hospital with a precisely similar attack. The rash appeared to commence on the chest, and spread over the arms, trunk, and extremities. It consisted of a red rash covered with fine thin scales. Both attacks proved very chronic. A lotion of bicarbonate (1-5000) was used, but had to be stopped on account of salivation.

Miliaria Rubra.—In various forms, such as scarlet fever, enteric, and in other febrile disorders, as rheumatism, a number of minute vesicles with clear contents make their appearance on the skin. The clear fluid is sweat, which has been unable to escape from the orifice of the sweat gland; the contents of the vesicles are absorbed or dry up in a day or two, leaving a tiny desquamating spot. In other cases a slight inflammation occurs at the blocked sweat gland, and a minute papule appears instead of the vesicle, though vesicles may also be present; this condition has been called **Miliaria rubra**. The so-called **Stichen strephulus** or 'red gum' is, according to Crocker, a sweat rash; it consists of minute crops of red papules which make their appearance in infants; they are attended often with much itching and consequent restlessness of the infant. A somewhat similar rash has been attributed to dermatitis as well as to gastric irritation. The papules should be dabbed with the lotion F. 35 or F. 42, and powdered with boracic acid or some drying dusting powder.

Pemphigus is rare in infants apart from syphilis, but attacks of the acute form of the disease (*Pemphigus neonatorum*), occurring in epidemics in lying-in hospitals or in the practice of a midwife, have been recorded by continental writers. In these cases the disease appears to have been directly contagious; not only has it apparently passed from infant to infant, but also from infant to nurse. In a few cases the eruption is preceded by fever, restlessness, or convulsions; the rash usually appears at the end of the first week. The bullæ vary in size; their contents are clear or slightly cloudy, rarely purulent; they gradually dry up, forming superficial ulcers or crabs. All parts of the body may be attacked, and, unlike syphilitic pemphigus, there is no preference for the palms of the hands or soles of the feet.

Chronic pemphigus is seen occasionally in older children; in some of these cases the children appear to be in good health and complain of nothing except the eruption, for which no cause can be assigned. In most cases there is marked anæmia, and more or less fever and constitutional disturbance; the liver may be swollen. The number of bullæ varies from two or three to perhaps twenty; they appear as vesicles on the face, trunk, and limbs, gradually enlarging, and finally drying up in the course of a few days. The treatment consists in giving arsenic in full doses, and cod-liver oil. Locally, boracic acid or zinc ointment may be applied. In the severer cases opium-baths are useful.

Dermatitis Gangrenosa Infantum.—In speaking of varicella we have referred to a peculiar form of multiple gangrene of the skin, which is apt to follow varicella in anæmic or emaciated children (pp. 291, 292). There is

reason to believe that this condition is not necessarily preceded by variola, but may follow other pustular eruptions (Crocot); it has been known also to follow vaccination. It almost always occurs in infants or young children under three years of age, and in many of the fatal cases umbilicosis has been found. In these cases the variola vesicle or pustule is succeeded by an ulcer, which rapidly extends in size and depth, frequently several joining together, so as to form large sinuous ulcers; the floor becomes black from the formation of sloughs. In the worst cases the scalp, face, body, and limbs are covered with sloughy-looking ulcers, either separate or having joined together. There may be marked constitutional symptoms. In one of our cases there was recovery, the ulcers gradually healing up; in the majority of cases a fatal result ensues. The treatment consists in giving the child a generous diet, including beef tea and wine, and dressing the ulcers with iodoform or other antiseptic ointment.

Drug Eruptions.—The most important rash belonging to this class is the **Bromide eruption**. In some children a few grains of a bromide salt are sufficient to cause a rash, while in other cases the salt may be taken for weeks or months together without giving rise to any eruption. Infants perhaps are more liable than older children. The rash consists in most cases of a red papular rash, the papules being discrete and chiefly occurring on the face, scalp, trunk, and limbs. On the summit of the red papules are one or more yellowish points, or small pustules. The rash looks more like acne than any other rash. It is sometimes confluent. Scratching and abrasion may take place (see p. 737).

A somewhat similar rash also occurs after taking **iodides**, but it is less common. **Antipyrin** and **Phenacetin** in some recorded cases have given rise to a "measly" eruption or an urticaria. We have several times noted a papular rash after giving antipyrin. The long administration of **Arsenic** is sometimes followed by a darkening of the skin, especially marked on the abdomen and trunk. The pigmentation disappears after the drug is left off.

Sulleylic acid or the soda salt sometimes gives rise to a "measly" or urticarial rash.

Tinea Tonsurans.—Ringworm of the scalp is one of the most troublesome local diseases with which the practitioner has to deal, and one which is apt to bring augmented discredit on account of the many months or even years that the disease sometimes lasts. In some children there seems to be an especial disposition of the disease to spread, and to relapse when it all appears to have been cured, or, in spite of the local treatment vigorously carried out for months, no marked improvement ensues and everyone concerned becomes tired of the case.

Ringworm is exceedingly contagious, our child taking it from another in consequence of the spores of the trichophyton being transferred from one to another by direct contact, or by means of hair-brushes, combs, caps, or bed-linen being used both by the affected and the healthy. It rarely affects infants, or children after puberty, its subjects, especially is the chronic form, being the weakly rather than the strong, though exceptions may be met with.

The disease when recent may be recognised at a glance: the patches are circular, the central skin in the smaller ones being red in colour, while it

the circiferente desquamation is freely going on, the heavy scurf giving the patch at this part a greyish or yellowish appearance; the hairs from the central part may have come away, or they have broken off, leaving stumps. In the larger patches all traces of reflex hairs disappeared, and they are simply bald or scurfy patches of varying size. Classic diffuse ringworm of the scalp, especially if it has undergone a certain amount of irritation as the result of treatment, is more difficult to diagnose; there may be much scurfiness, perhaps scratching and pustulation. In the condition known as *kerion* the hair follicles suppurate, the hairs becoming loosened at their roots, and there is redness and puffiness of the patch. The diagnosis of ringworm is made from the stumps of hair left after the hair has broken off. These are best seen by means of a lens of two or three inches focal length; the stumps will then be readily seen often more or less curved or bent, and having lost the gloss ordinarily seen on the hair. They are readily extracted with forceps, as they are mostly loose in their follicles; they can then be placed upon a glass slide with a drop of liq. potassæ and examined after soaking for half an hour. The broken hair will be seen to be frayed out at the end, and moreover infiltrated with coagula or spores; the latter are readily seen with a power of 300 diameters if a sufficient time has been allowed for the caustic alkali to dissolve the fatty matters and render the hair transparent. The mycelium is less readily seen than the spores. It is needless to say it is mostly useless to examine the unbroken hairs, and in old cases which have been treated no spores may be present in the scurf. The greatest caution must be exercised before pronouncing that a case is well, or certifying that it is no longer infectious, as cases relapse again and again, and may be the means of communicating the disease to others. Before any case can be said to be cured, repeated examinations must be made with the aid of a lens for detached hairs, any suspicious-looking stump being extracted and examined microscopically; it is well to remember also that scurfy patches, even when the hair is growing freely over them, are extremely suspicious. In every case some mild parasiticide should be continued to be applied for some time after the disease appears to have been eradicated. In seborrhoea or non-parasitic scurfiness the whole scalp is affected, and, though the hair may come out, there are no broken stumps and no sharply defined patches of scurfiness as in ringworm.

The course of ringworm is apt to be exceedingly chronic, and when undertaking the treatment of a case it is well not to be too ready to name a definite time when it will be well.

Tinea Circinata.—Ringworm of the body is frequently associated with ringworm of the scalp. It is first seen as a raised red spot, which becomes scaly at the periphery as it enlarges, while the centre may present more or less healthy skin; as the ring enlarges it becomes more or less broken and fainter. It may be present on all parts of the body; it is perhaps commonest on the face and neck. The diagnosis is generally easy, though sometimes the patches of scurfiness on children's faces may be mistaken for ringworm, but do not assume the formation of a ring with a normal skin in the centre; if any difficulty occurs, an examination of the scales scraped off the patch for spores would decide.

Treatment.—The treatment of *tinea circinata* is a comparatively simple

affair, and is readily effected by the continuous application of some caustical ointment or solution for a few days or a week. It is well to commence treatment by removing the scales as far as possible with soap and water, and then some dilute white precipitate ointment may be gently rubbed into the patch morning and evening. An ointment containing salicyl, $\frac{5}{16}$, and iodo-pur (eq. $\frac{5}{16}$ to the mass of heated oil also answers well. Carbolic oil or carbolic acid in glycerine (1-8) may be used.

In the treatment of ringworm of the scalp the first step to be taken is to cut the whole hair off with a pair of scissors to at least half an inch, leaving a fringe if thought desirable; the scalp can then be carefully examined, and it will be usually found that there is more extensive disease than was at first thought. Wherever there are any patches of ringworm the hair must be cut close to the scalp both over and around the patch. The scalp should be thoroughly washed with soft soap or carbolic soap, removing all traces of the scales as possible. The ointment or application selected should then be rubbed in by means of a mop of rag for a few minutes, at least twice a day. Very many parasitocides have been recommended; the one we have mostly used, and which is certainly as successful as any, is the ointment of mercury, and we fully endorse Dr. Alder Smith's praises of it. An ointment containing 5 per cent. is used for children under eight years of age, and to get rid of for older children; a small piece of the ointment is rubbed vigorously into the affected patch every morning and evening; if there is much tenderness it must be rubbed for a day or two. Once a week at least the ointment should be washed off with soft soap, and effects of treatment carefully noted. Ointment of mercury is especially suited for the diffuse form of ringworm; it apparently penetrates better than iodine or carbonic acid, which tend to harden the epithelial tissues; this power of penetration is obviously of great advantage when the fungus extensively affects the hair roots.

In the early stages, when there is a single circumscribed patch of ringworm or only a few patches, some more powerful remedy than the 5 per cent. ointment of mercury may be used with advantage. The 50 per cent. ointment may be applied, or carbolic acid and glycerine (1-5 by measure) may be rubbed into the patches night and morning. Coner's paint (iodine $\frac{5}{16}$, oil of cade $\frac{3}{16}$) is also useful in recent cases painted on the patch, removing the crust every five days and reapplying. Glacial acetic acid and hydrag. perchlorid. $\frac{1}{16}$ is ad. $\frac{1}{16}$ as used by Alder Smith are good applications, as is also Anker's solution of chrysarobin in chloroform (F. 47). The last two must only be used in circumscribed small patches, and are not suitable for young children or those in whom inflammation is readily set up. It is well to keep the rest of the scalp well oiled with carbolic oil when strong applications are being applied to some local patch. A light straw-rag should be worn to prevent the ointment staining the bed linen at night.

While in the chronic or diffuse form we prefer mercurial preparations, yet some cases appear benefited by a change, or at any rate a change of ointment will sometimes work wonders in the eyes of the friends. An ointment containing equal quantities of carbolic acid (Calvert's No. 5), erg. hyd. nitr., and iodo-sulphur (Alder Smith), is a good and useful one; or the formula (F. 45) recommended by Jarrold.

Whatever form of application is adopted, it is tolerably certain that much patience will have to be exercised before the disease can be pronounced cured. Weeks and even months may elapse, and while progress has been made perhaps scabiness and diseased crumps can be detected: or, perhaps, while the disease appears eradicated in one place, it is spreading in another direction.

Epilation is useful in all stages, but timid and young children are too nervous to submit to much being done in this way. In cases which have proved intractable and resisted all treatment for months a local patch of inflammation may be set up by means of *cotton oil*. The usual method is to paint some cotton oil on over a patch of half an inch to an inch in diameter, to repeat it the next day, and to follow it up by a poultice; the patch becomes red and puffy, suppuration takes place about the hair follicles, and the hairs readily come out. To this buggy condition the term *kerion* is applied. It is important to apply this treatment to only small patches at a time.

After the disease has been apparently cured it is well to continue for a time with some remedy containing a mild parasiticide. One of the formulas 25 or 30 usually answers for this purpose.

Alopecia Areata.—Alopecia consists of smooth, shining, bald patches on the scalp. It occurs at all ages, both of childhood and adult life. Its cause is uncertain, though there is a consensus of opinion that it is not due to any fungus. In some cases it follows severe headaches, in others there is no known cause, though it occurs mostly in those who are below par and out of health. It may occur first in patches, and perhaps after a while involve the whole scalp. It is extremely intractable, and little influenced by treatment local or constitutional. Cod-liver oil and tonics are usually given, and stimulating lotions, such as F, 31.

Favus.—Favus is not a common disease in this country, but is occasionally seen among our patients at a children's hospital. It is known at once by the peculiar yellow cup-like depressions formed by the crusts, and by the peculiar 'mousy' smell. These crusts can be raised from the scalp by means of a blunt knife, carrying the hairs with them, leaving a pitted skin, which, however, crusts over again in ten or twelve days. The favus crusts may be present on the body as well as on the scalp. The subjects of this disease are generally enfeebled and have been ill fed. The fungus—a *fungus Schoddekeri*—closely resembles the trichophyton of ringworm, but the mycelium is more pitted, and the germs are more numerous and larger, though they vary much in size.

The disease is very chronic, frequently lasting for years. The treatment consists in removing the crusts, applying parasiticides, and administering cod-liver oil and iron.

Scabies.—Scabies is very common in infants and children in dispensary practice, and by no means unknown among the well-to-do classes of society. Among the former there is rarely any difficulty in diagnosis, as they usually do not prevent themselves till the disease is well-marked and pustules have formed, while in private practice the diagnosis may be difficult when the disease is local, as, for instance, on the hands. In infants and young children scabies gives rise to more irritation than in adults, and in infants at the breast *eruptio*

and erythema of a more or less severe nature may be frequently seen. In infants the hands may be quite free, while the face and legs or genitals may be affected. In cachectic or weakly children there are usually much crusting and many pustules, pus being transferred from one part to another by means of the finger-nails. The diagnosis is not usually difficult; urticaria, simple eczema, and lichenous eruptions may be mistaken for it. The presence of burrows, the irregular distribution of the vesicles and pustules, as well as the intercircles, are the characteristic points. We have, however, sometimes been in doubt regarding the nature of itching rashes present only on the backs of the hands. A cure is readily effected by a hot bath with the copious use of soft soap, followed by sulphur or stearic ointment; the bath and ointment should be repeated for four or five nights in succession, and the clothes should be steamed. (F. 37, 53, 14.)

Simple Onychia in children may be looked upon as a variety of the subcuticular form of whitlow, in which the nail matrix is involved instead of the skin of the finger. It is usually the result of some slight injury such as nail-biting, missing a splinter beneath the nail, or too close cutting of the nails. Early letting out of the matter and removal of foreign material, with subsequent warm water or lead lotion dressing, is all that is required. Occasionally suppuration goes on intractably beneath the nail, or recurs again and again after drying up; in such cases the nail should be cut away over the inflamed spot, and the surface scraped clean, and some solid nitrate of silver applied.

Onychia Maligna is a rare formidable affection, nearly, if not quite, always due to injury of the finger end. The whole nail matrix becomes inflamed, the end of the finger is swollen, congested, and bulbous, the nail becomes loosened, curled up, and blackened, and there is much burning pain; a dirty, semi-malignant, often foul discharge comes away, and the mischief may go on for months if neglected, and even give rise to necrosis of the terminal phalanx and permanent distortion or destruction of the nail. The treatment we have hardly ever found to fail is dusting the raw surface over with powdered nitrate of lead night and morning for a few days; the nail should be removed if the disease has involved anything more than the upper part of the matrix. We have often seen onychia of many months' standing get practically well in a week under this treatment. Occasionally it is necessary to scrape away the diseased tissue and remove a sequestrum, but this is quite exceptional.

Lupus.—Mention has already been made of superficial tuberculous elevation of the skin (*vide* p. 383), but the special form known as *lupus vulgaris* needs a short notice here. The affection consists in the development of small circular deposits of inflammatory material in the thickness of the true skin. These deposits, known as 'lupus tubercles,' are found usually in patches which tend to spread by the formation of new tubercles at the margin of the patch. At first isolated, after a while the tubercles coalesce and break down, forming a larger or smaller superficially ulcerated patch, which is usually coated over with thick scabs or crusts. In earlier stages there is no obvious alteration, and a thin pellicle covers over each 'tubercle.' If allowed to spread, extensive destruction of the skin may occur, and the deeper structures are in certain cases attacked. It is, however, very rare for lupus

to penetrate through the deep fascia, and it probably never attacks bone. The most extensive destruction is usually of the nose, where the whole of the lateral and alar cartilages may be eaten away, leaving a short, pointed, and shrunken organ. Almost any part of the body may be attacked, but the face is the favorite seat, and especially the tip and sides of the nose. Less often the disease attacks the mucous membrane of the lips, cheeks, and septum nasi, and we have seen the nasal and soft palate involved by extension from a patch of lupus at the angle of the mouth. Chronic in its course, and intractable to any but very thorough treatment, lupus is one of the most troublesome of the skin diseases met with in tuberculous subjects, especially as great deformity and disfigurement are often produced by its ravages. On scraping out a 'lupus tubercle' a hollow or pit is seen in the thickness of the dermis, while at the edge of the patch the superficial part of the skin is undermined.

Treatment.—The general treatment is that of tuberculous, cod-liver oil and arsenic being of especial value. Locally nothing is so effectual as thorough removal of the disease mechanically. It is best to give an anæsthetic, and thoroughly scrape away and dig out all the soft tissue with a sharp spoon. All the material that can be scraped away should be removed; healthy skin will not break down under the use of a Volkmann's spoon. After the scraping the actual cautery or solid nitrate of silver, or, better still, powdered nitrate of lead, may be applied, but the mechanical removal is the most important part of the process. There is free bleeding at the time, but this speedily stops. The sore should be dressed with oxidized zinc ointment, and a careful watch kept for the appearance of fresh tubercles, which should be at once attacked in the same way. The repeated application of powdered nitrate of lead has been very useful in our hands, both for lupus and other intractable tuberculous sores; it is somewhat painful but very effective.

Papilloma.—Warts are very commonly met with on children's hands, and often appear in crops. They frequently disappear spontaneously, but if they are troublesome may be readily cured by some caustic application, or better by the steady use of salicylic acid.

Hairy and Pigmented Moles occur congenitally, and sometimes cause great disfigurement, as in fig. 182. If small they may be treated by excision. If extensive the growth may be removed in sections by the application of the actual cautery or strong nitric acid, but it must be remembered that any of these methods necessarily leave a scar. Mere overgrowth of hair may be removed by electrolysis and epilation.



FIG. 182.—Hairy mole of the face and scalp. A large part of the patch was removed by the use of the actual cautery and electrolysis.

CHAPTER XXXVI

INJURIES, SHOCK, HÆMORRHAGE, &c.

Two various injuries met with in children can only be very briefly described here, and only those more or less peculiar to childhood will be mentioned.

Injuries to the Head.—In young children it is not uncommon for one of the bones of the vault of the skull to be dented or dinged in, and a well-marked but shallow saucer-like depression may be felt. Care must be taken to distinguish this lesion from cephalo-hæmatoma (1866 p. 205). The symptoms of brain injury in such a case are usually those of concussion and often speedily pass off; recovery usually takes place without any bad symptoms, and the depression in most instances gradually becomes obliterated by pressure from within and moulding of the bone.

The treatment of such cases is simply rest and quiet; no operation is called for. Sometimes, however, where the depression is more abrupt and marked symptoms of compression exist, especially if the fracture is compound, the general lines of treatment for such cases in adults must be followed. In children the rule, however, is not to operate unless the fracture is compound.

Traumatic Cephalo-hydrocele is the name applied to a condition where there has been a simple fracture of the skull, with probably in all cases laceration of brain and laying open of one or other lateral ventricle. The fluid contained in the ventricle escapes beneath the scalp and forms a soft, fluctuating, usually pulsating swelling; this is distinguished from hæmatoma in some cases by its later onset and steady increase. The swelling, however, may appear immediately; sometimes it is not seen for some months after the injury; in any doubtful case aspiration would settle the point.

Cephalo-hydrocele is most often met with in children under two years old, but may occur as late as the twelfth year; it is most common in the parietal region. We have seen several of these cases. There is often extensive absorption of bone after the injury, so that a considerable gap is left in the skull. Hydrocephalus not rarely ensues.

Treatment.—Tapping appears to be of little use; and patients and quiet are the only treatment. A plastic operation has been proposed to close the aperture in the skull, and might possibly be advisable in any case that was clearly getting worse.

The mortality is high: some 40 per cent. of the patients die; in some instances temporary recovery takes place and meningitis develops later.

¹ *Lancet*, *Child's Bites*, 1885, *et seq.* (T. Smith, *St. Barth's Hosp.*, 1884). *Exposé*, *Northam, Gollon, Howard, and Connor* have reported cases; also *Killing and Gay's Rep.*, 1885. *Year-Book of Treatment*, 1885, p. 196.

Occasionally after compound fracture of the vault a free escape of similar fluid occurs, as in one case of our own; there was a compound depressed fracture of the frontal bone, which required elevation: an abundant flow of clear fluid took place from the wound before operation; the boy recovered without any bad symptoms.

Fracture of the Base of the Skull in children is a much less serious injury than in adults, and is often completely recovered from. Traumatic meningitis is rare in children, and they generally recover well from convulsions and brain laceration.

Dr. Allen ('Lancet,' October 22, 1885) has described a fracture dislocation of the atlas occurring in infants; the lesion is marked by hyper-extension of the head and a liability to 'epileptic fits' on attempts at extension or pressure downwards upon the head. The injury is probably inflicted during parturition. *Also* Gairn, 'Gaz. Médic., 1851.

Injuries of the Chest.—The only fact about chest injuries that is peculiar to childhood is that, in consequence of the flexibility of the chest-wall, visceral lesions without fracture of the ribs are not uncommon. When rupture of the lung occurs the laceration is usually in the neighbourhood of the root of the lung, and the usual complications—*emphysema*, *hemothorax*, and *hæmoptysis*—are often present, though the last is less often seen, since young children rarely expectorate, and the blood is swallowed.

Injuries of the Abdomen have no peculiar features; if the immediate shock is recovered from, subsequent complications are rarely fatal unless from some severe visceral laceration.

Fracture of the pelvis in childhood is less likely to be complicated by visceral injuries than in adults, since sub-peritoneal fractures and separation of epiphyses take place in children. We have met with a case of fractured pelvis in which the architrave was separated from its normal position beneath the pubic arch and displaced backwards towards the anus, the injury occurring in a little girl.

Rupture of the membranous or spongy urethra is not uncommonly met with in boys as a result of falling aside some projecting edge, e.g. the top of a palings or of a gate, or the bough of a tree. The symptoms are pain and swelling in the perineum, escape of blood from the urethra, inability to pass urine, and distension of the bladder unless it has been recently emptied. A gentle attempt should at once be made to pass a catheter; if this succeeds, the instrument should be tied in for three or four days and then changed; after a week or ten days it is sufficient to pass a full-sized catheter daily. This is the orthodox treatment, but a traumatic stricture usually results, requiring the passage of instruments frequently throughout life. Extravasation of urine often occurs either immediately or within a day or two of the accident, and necessitates free incisions into all the infiltrated parts. To avoid these misfortunes probably the best plan is, immediately after the accident, to cut down upon and suture together the ends of the torn urethra. This we have done with excellent results in adults, and, as a secondary operation, in a child.

Injuries of the Limbs.—The peculiarities of injuries to the limb bones in children depend mainly upon two facts. 1. The bones of children are soft, contain relatively little earthy matter, and are therefore less brittle

than those of adults. 2. The epiphyseæ are yet ununited, and the periosteum is thicker, more easily detached, and more freely supplied with blood than in older people.

Greenstick Fractures.—A greenstick fracture is one where more or less of the thickness of a bone has been crushed instead of snapping across; there is probably really always a fracture. Simple bending of bone without fracture is of doubtful occurrence, in health at least, though it may occur in rickets and osteomalacia. Many fractures in children are subperiosteal, and to this fact and to the incompleteness of the fracture is due the absence of marked symptoms in many cases, so that fractures are not rarely overlooked; indent, deformity, obvious mobility, and crepitus may all be absent, and it is common enough to see a fractured clavicle of a week's or a fortnight's standing, or even longer, in which the first sign that attracted the parent's attention was the 'lamp in the neck,' consisting of callus round the fractured ends. Hence, after any severe injury, such pain and look should be systematically watched, especially in very young children, for all probable injuries. The treatment of greenstick fractures is the same as for ordinary fractures, viz. displacement being at once forcibly reduced.

Ununited Fractures.—Fractures in children usually unite well, and even in scrofuly patients non-union is rare. We have already mentioned cases of non-union in fracture after necrosis of the tibia and femur. Occasionally one or more of the long bones is fractured at, or shortly after birth, or even in utero, and in these cases non-union is not very rarely met with. It is a curious fact that such fractures have almost universally resisted all attempts to produce union when once the ends of the bones have become atrophied and a false joint has formed. Sir James Paget has pointed out this peculiarity.¹ In one of our patients we tried many methods before obtaining union, as will be seen below.

Case.—John H., at six weeks old, was found to have a fracture of the leg, but it was not known how long it had existed. The mother said a fall two months before he was born. On admission there was an old assumed fracture of both bones of the right leg 1½ inch above the ankle; the limb was knee and almost full-size. In May the ends of the bones were exposed, and the first week necrosis followed. He was vaccinated in July and patient of Ford resupplied. In October the ends, which were much atrophied, were again exposed, and ten pieces of bone, taken from the femur of a recently killed young rabbit, were grafted in. The wound healed by primary union, and the limb was going in plaster. No union nor even any formation of callus followed. In January digital an operation was repeated; eight grafts being inserted, the wound was closed and the limb put up in plaster. Three pieces of the rabbit's bone were removed in April and May, and the wound healed. In June the wound was reopened, and a long piece of rabbit's bone wedged in between the ends. The wound healed at once, and a good deal of thickening, but no real union, followed. In April the wound was reopened and the large piece of rabbit's bone fixed here and encased in a matrix containing three yellow, fluid smaller pieces, which were fixed embedded in Bioness (case); there was no sign of any union. The rabbit's bone was removed and the ends of the tibia fractured; an inch of the tibia of the same leg was then taken from just below its head and fixed in between the ends of the tibia. No union followed, and in September 1891 the ends were again exposed, and stout steel pins driven transverse through the fragments, which, by reason of the shortening of the tibia, could be brought well into apposition. Around the ends of the pins silver wire was wrapped as in a basket of wire; the wound was closed and the

which fixed in plaster. In December, 1894, the plaster was removed, and the bones were found united; one of the joints was removed and the limb fixed in plaster of Paris. The union was firm when the limb was examined in August 1895, and the wound was again closed, but the limb was still weak, and no restoration of the limb had taken place. Dr. J. C. Fowler has collected a series of 32 cases, in 21 of these, attempts to restore union failed. (*Med. Clin. Trans., vol. 20, 1895.*)

Separation of Epiphyses.—It has been well established by Hnikowski and others, especially by the French surgeons, that a joint epiphyseal separation is very rare; the condition is nearly always a combination of separation of the epiphysis with a fracture of the shaft; that is, the line of separation runs partly through cartilage and partly through bone. The periosteum in many of these cases remains intact, and, as Mr. Hutchinson has shown, it is in many instances extensively stripped up from the diaphysis, and necrosis may follow. Hence the symptoms of epiphyseal separation or diastasis vary considerably; thus there may be little or no displacement, crepitus may be absent, or very indistinct; and undue mobility may be only recognisable on very careful manipulation. We have seen many cases in which there has been a history of previous injury, supposed to be a strain, in which the amount of thickening found at the time of examination makes it almost certain that a more or less complete separation of an epiphysis had occurred. This is especially common about the lower end of the humerus, and our experience fully bears out Mr. Hutchinson's statement that these accidents are exceedingly common, and in any doubtful case of injury about the elbow they should always be suspected. Curiously Hamilton (*Fractures and Dislocations*) says he has never met with a case. It is, however, possible that in some instances the violence may strip up muscles and the thick bone periosteum without any fracture or diastasis, and this injury of the periosteum may be the cause of the subsequent thickening.

In well-ranked cases there are deformity, undue mobility, loss of power, and sometimes indistinct or so-called 'false' or 'dancer's' crepitus; the outlines of the fragments are more rounded than in ordinary fracture, and the line of separation coincides with that of an epiphysis. It must be remembered that an epiphyseal fracture is not a flat, glass surface, but there is in most of the bones a cup-shaped hollow in the epiphysis which receives the rounded convex end of the shaft. It is often difficult to reduce and keep in place the fragments, and a certain amount of deformity is often permanent, though this diminishes by a gradual process of modelling as time goes on. Arrest of growth occurs in some cases, not in others; probably this depends upon the accuracy with which the lesion has followed the epiphyseal line, and the amount of destruction of the growing bone, or of premature synostosis that results. Occasionally acute necrosis of a separated epiphysis occurs, or at least some suppuration around it, and this is said to be disproportionately frequent in cases of separation of the epiphysis of the great trochanter. (Hutchinson, junior.) These injuries are most common about the two ends of the humerus, the lower end of the radius, and the lower end of the femur. It is sometimes said that separation of the lower end of the femur is the most frequent accident, but in our experience it is not nearly so common as the diastasis of the humerus. We have once met with diastasis of the upper femoral epiphysis (vide *'Hip Disease in Childhood,'* by one of the present

written),¹ occasionally distant are met with at the upper end of the shaft,² and elsewhere.³ Tabby⁴ has collected cases of separation of the clavicular epiphysis. The diagnosis depends upon the age of the patient, the fact that the projecting edge of the bone is sharp and unlike the natural near end



Fig. 111.—Separation of the upper Epiphysis of the Right Humerus.

of the clavicle as it would be in the case of a dislocation, and also in that a lamella of bone can be felt between the sternal notch and the end of the shaft. It must be remembered that the epiphysis is only an extremely thin plate. The treatment is that of fractured clavicle.

According to Tabby separation of the coracoid epiphysis is of extreme rarity, and no case of separation of the acromial epiphysis appears to be authentic.

Distant of the upper end of the humerus is not rarely met with. It results from exposure such as blows or falls upon the arm, which, in the adult, would probably cause either fracture of the shaft or dislocation of the shoulder. The appearance of the shoulder is characteristic, though much like that of fracture of the surgical neck of the bone.

There is no depression below the acromion, but some flattening a little lower down, with a marked prominence on the anterior and inner aspect of the arm, a short

distance below the coracoid process. This prominence is the upper end of the shaft of the humerus displaced forwards and upwards; the edges of the projecting bone are more rounded, and less sharp and irregular than in the case of fractured surgical neck, and on reduction, which is usually, though with difficulty, managed, a "dumny" crepitus instead of that of a true fracture is felt. It is difficult to keep the fragments in position, but, as the surface

¹ See also Maudsley on Fractures, and Handbloom, *Arch. of Surgery*, April 1890, and Tabby, *Annals of Surgery*, 1894, vol. xxx.

² Separation of the upper epiphysis of the clav has been caused by the bad position of applying traction for leg disease below the knee instead of above it.

³ For an account of separation of epiphyses due to congenital syphilis (epiphysal osteitis) vide chapters on "Congenital Syphilis" and on "Bone Disease." Similar multiple separations may be the result of so-called "marry poison."

⁴ *Am. Reports*, 1889.

are broad, there is very rarely or never any actual overlapping. Since the upper epiphysis of the humerus includes the vascularity, there is abundant blood supply to the upper fragment, and union usually takes place speedily. The treatment consists in applying a long inside angular splint, well padded at the top and fitting high up into the axilla. The fragments are brought into position, and a felt or gamma-percha shoulder-cap is then moulded on. Passive movement should be begun in ten days. The deformity is rarely entirely reduced, but good union and a useful though possibly somewhat shortened limb result. The injury may be compound or complicated with rupture of the axillary artery. Instances of non-union have been met with, and shortening to the extent of five inches ten years after the injury. In some cases carrying the arm "forwards and upwards to the perpendicular line"—Moore quoted by Tablin—will render reduction easy.

Separation of the lower epiphysis of the humerus is, we think, far the commonest lesion of the kind met with in children. We believe the most frequent injury is separation of the lower condyle, i.e. the epiphysis of the trochlea together with that of the epicondyle. J. Hutchinson, *yes*, thinks separation of the inner epicondyle is the most frequent lesion, and that it never becomes united by bone when once separated. The line of disjunction runs from above the condyle into the joint between the trochlea and capitulum. It is very common to have children brought with an injury to the elbow of some days' duration, and a statement that the limb has been sprained or the joint put out. On examination there is pain and restricted movement about the elbow joint, but the olecranon, the head of the radius, and the internal condyle occupy their normal relations to one another. Sometimes, however, the disaster is accompanied by dislocation of the joint, and paralysis of the ulnar nerve may

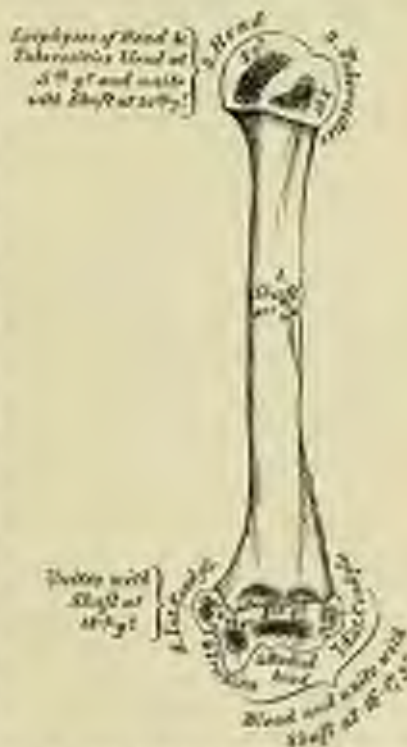


FIG. 114.—Plan of the Development of the Humerus. Epiphyseal Centers. From Gray's Anatomy.

be met with. On grasping the lower end of the humerus between the finger and thumb, marked thickening as compared with the other side is felt usually just above the internal condyle. Sometimes the whole lower epiphysis is separated and displaced backwards; less often the capitulum and

eter condyle are detached. Such cases, if seen at once, should be treated, after reduction of any obvious deformity, by gutta-percha or Gough splint, on one side, and on the other an angular splint, reaching from the shoulder to the end of the fingers. Treatment of these injuries of the lower end of the humerus by keeping the arm extended has been recommended as tending to diminish the displacement due to contraction of the triceps and the tendency to tilting of the fragments, but this method of treatment has not become the accepted one. H. O. Thomas, R. Jones, and others recommend treatment by supination and extension, followed by acute flexion of the elbow.¹ At the end of a week the splints should be removed, gentle active



Fig. 14. Separation of trochlear epiphysis of humerus, showing adhesion of the humerus with loss of the "carrying angle."



Fig. 15. Areas of growth of the radius from separation of the lower epiphysis many years later.

movement encouraged, and the splints readjusted. A week later all splints should be left off and the arm worn in a sling, but taken out night and morning for gentle exercise. Violent passive movement to keep up flexibility is un-chievous and delays the cure, since the irritation increases the amount of callus thrown out. If no passive or forcible movement is allowed, but just gentle voluntary exercise, absorption of all thickening gradually takes place, and provided the displacement has been fairly corrected, almost perfect mobility will return in the course of a few months. The great point in treatment is to reduce the deformity and avoid forcible movement; but as

¹ *Brit. Med. Jour.*, January 23, 1903, and November 5, 1904.

courage gentle active movements after about the end of the first week. The ultimate prognosis is good as regards mobility, though uncertain as to arrest of growth. It occasionally happens that after separation of the whole lower femoral epiphysis union takes place with the lower segment of the limb adducted, i.e. there is loss of the 'carrying angle,' and an straightly and somewhat awkward limb (vide fig. 135). In one case we twice resectomised the humerus to remedy the deformity, which, however, recurred. Separation of the tibia epiphysis is occasionally met with, and we have once seen a case of compound separation of the upper epiphysis with a good result.

Separation of the lower epiphysis of the radius with fracture of the ulna is said to differ from Colles's fracture in that the palmar projection is more obvious, the hand is not held so obliquely, i.e. there is not so much radial adduction, and the dorsal groove is horizontal instead of oblique. There is more resemblance to dislocation of the carpus backwards, but this is an exceedingly rare injury, and in it the styloid processes do not maintain their normal relations in the carpus as they do in fracture, while the age of the patient and the sensation of crepitus, together with the ease of reduction, but ready renewal of deformity, will point to diagnosis.¹ If the ulna is not fractured the resemblance to Colles's fracture is very close, and the treatment is the same. For cases illustrating these injuries in the upper extremities we must refer to Mr. Tully's paper. Arrest of growth may follow (fig. 136). Very rarely the upper epiphysis of the radius is detached. We have once met with a case of separation of the symphysis pubis associated with rupture of the urethra.

In separation of the lower epiphysis of the femur the lower fragment is usually displaced forwards, and the backward pressure of the diaphysis upon the vessels may cause gangrene, as in cases of Wheelhouse's, and McGill's of Leeds.² We have seen cases of compound separation of the lower epiphysis with similar displacement. The displacement should be rectified under chloroform, and the limb put upon a Macintyre's splint on an inclined plane. If necessary, the part should be exposed by operation and the deformity reduced. In many cases the onset of gangrene appears to have necessitated amputation.³ The displacement is occasionally lateral.

In separation of the upper epiphysis of the tibia, which is exceedingly rare, according to Tully the epiphysis is displaced backwards and the deformity tends to recur after reduction. We have seen a remarkable case of separation of the lower epiphysis of the tibia in a boy of about ten years, who was under the care



FIG. 135.—Separation of lower epiphysis of left femur. The epiphysis is displaced forwards, and the knee is flexed.

¹ Vide R. W. Smith on *Fractures and Dislocations*.

² *Brit. Med. Jour.* May 24, 1884.

³ Mayo Robson, *Annals of Surgery*, 1893, vol. xviii; Tully, *Annals of Surgery*, 1895, vol. xix.

of our colleague Mr. Hardie. The case was complicated by the presence of a cortical fracture running upwards from the epiphyseal line. The fore and lower fragments were displaced outwards, and the deformity could not be reduced until some weeks after the accident, when the ends of the bone were exposed by operation and with some difficulty replaced. We have also met with an instance of compound separation of the lower epiphysis of the femur. The lower fragment became necrosed and was removed.

The diagnosis of epiphyseal separations need not be further described here: the locality, age of the patient, and the symptoms mentioned usually make the case clear, and any injury in the neighbourhood of a joint of doubtful character should be treated as if a diastasis had occurred. After a few days the subsidence of the general swelling and the presence or absence of callus will clear up the doubt, even if a careful examination under chloroform fails to reveal the exact nature of the injury.

For further details, with records of cases, we must refer to Mr. Tabby's interesting papers, and to Mr. J. Hutchinson's, *joint, Lectures*, published in the *British Medical Journal*, 1893-94.

The treatment of these cases is simply that of a fracture in the same position, though lighter appliances may of course be used in the case of children than of adults; thus plaster of Paris, Gooch's splint, Hader's felt, gutta serena or light wooden splints may be employed. Most careful guarding is necessary in all cases to protect the tender skin; absorbent wool will be found the best material for this purpose.

In separation of the lower epiphysis of the femur, as already stated, the limb should be put up in the flexed position, since the gastrocnemius, when attached to the upper or lower fragment, tends to tilt the ends of the bone.

Stimson mentions that Volkmann has three times separated the lower epiphysis of the femur in manipulations required in cases of hip disease; we once met with the same mishap in a case of acute suppurative arthritis in an infant. The case with which diastasis occurred was probably due to inflammation or atrophic softening of the epiphyseal line. The child recovered without arrest of growth.

In all cases a guarded opinion should be given as to the future mobility of the adjacent joint, and movement should be begun early—in the case of the elbow not later than the end of the first week, the splints being strapped afterwards, and movement employed daily after the first fortnight; a little longer may be given for other joints. No forcible passive movement should be employed; if the fragments have been replaced it is unnecessary and even harmful; if they are still out of position, forcible movement is useless; and if, after time has been given for absorption and modelling down of the parts, the limb is still seriously crippled, it is probably better either to reset the joint or to cut down upon and chisel away any projecting fragments of bone. Hence, if it is found that the thickening does not subside it is well to cease movement and allow the parts to settle down, and mobility will probably return without any special effort. Separated epiphyses unite with great rapidity, much more so than fractures. Even if there are considerable thickening and distortion for some weeks after the injury, and perhaps considerable loss of power and mobility, so much modelling of the joint takes place that ultimately the result is usually good.

In cases of compound separation of an epiphysis it may be necessary to amputate part of the shaft of the long bone in order to reduce the displacement. Even in such cases the amount of ultimate shortening may be very little, though it is quite uncertain how much it will be.

Implication of the musculo-spiral nerve in the callus of a separated lower epiphysis of the humerus is not uncommon, and there may be paralysis of the nerve for a time; usually, however, this disappears, and no hasty operation for the release of the nerve is called for.

The following table of the dates of ossification and union of the epiphyses of the principal long bones is inserted from Quain's 'Anatomy.'

Humerus.

Nucleus of head appears in second year.

" capitulum appears in third year.

" internal condyle appears in fifth year.

" trochlea appears in eleventh to twelfth year.

" external condyle appears in thirteenth or fourteenth year.

The lower epiphysis unites with shaft in sixteenth to eighteenth year.

The upper epiphysis unites with shaft in twentieth year.¹

Radius.

Nucleus of lower extremity appears at end of second year.

" head appears in fifth year.

Upper epiphysis and shaft join in seventeenth to eighteenth year.

Lower epiphysis and shaft join in twentieth year.

Ulna.

Nucleus of lower end appears at ninth month.

" head appears at end of first year.

Head joins shaft at eighteenth or nineteenth year.

Lower epiphysis joins shaft after twentieth year.

Tibia.

Upper epiphysis appears about time of birth.

Lower epiphysis appears in second year.

Lower epiphysis joins shaft in eighteenth to nineteenth year.

Upper epiphysis joins shaft in twenty-first or twenty-second year.

Farther details in regard to the important subject of disjunction of epiphyses will be found in the papers of Messrs. Todd and Hutchinson already referred to.

Simple complete fractures of the long bones may be met with at any age, and even occur sometimes in utero; indeed, compound fractures may occur before birth. Intra-uterine fractures may be the result of falls or of blows upon the mother's abdomen, or of muscular contraction, and are sometimes associated with intra-uterine rickets. Almost any number of fractures

¹ Osmond says sometimes as late as the twenty-fifth year.

may thus occur; two were found in one instance and 115 in another. Such fractures may be found united at birth; they are not very rarely produced during labour by instruments or traction upon a limb.

Fractures of the clavicle in quite young children are best treated by a darning bandage to fix the arm to the side with the hand on the opposite shoulder, and a soft pad of absorbent wool in the axilla. The child's arm is, of course, kept inside its clothes, and not put through a sleeve; as Mr. Owen suggests, a jersey may be usefully worn over the bandage to keep the limb quiet. In this, as in all fractures, it is an excellent plan to keep the skin well powdered with boracic acid or sanitary rose powder, so as to prevent irritation of the skin.

Fractures of the arm are treated in the ordinary way: the splints should always be carried well up to the ends of the fingers to prevent disturbance of the fragments by the restless movements of children. We are well aware that this is not usually recommended, but we believe it to be the proper, as it certainly is the anatomically correct plan. Fractures of the pelvis are treated by bandaging the legs together firmly with a broad darning bandage, which is carried upwards to above the crests of the ilia, the child being, of course, kept in bed.

In fractures of the femur in babies under a year old a piece of gutta-percha or Gooch's¹ splint, lined with wool, should be applied to the thigh, and the legs bandaged together with a darning bandage; this is, we think, the simplest, cleanest, and, on the whole, most effectual plan, though a good result may be obtained by almost any method. In older children, up to the third or fourth year, we prefer the vertical suspension plan, as more cleanly and efficient, and less troublesome; after it is once applied than other methods; simple extension by a weight, with Gooch's splint, or an outside long splint, is, however, satisfactory, and a Cook's, a Baranin, or a Thomas's hip splint should be applied at the end of a fortnight. Thomas's knee splint may also be used very successfully in fractures of the lower half of the femur.

After fracture of the thigh in simple cases there should not be at most more than half an inch shortening in young children, and this will very slowly disappear after a time.

Fractures of the leg should be treated by a back splint with a foot-piece and two side splints for the first ten days or a fortnight, or more, according to age, and then one of the forms of stiff apparatus applied.

In all cases the most careful watch must be kept for tight bandages; no bandage should ever be applied beneath a splint, nor should a limb be ever bandaged in extension and then put up in flexion. Pressure sores and gangrene are real dangers in children.

As is well known, any cause, such as hip disease, infantile paralysis, old ankylosis with atrophied bone, rickets, and so on, may produce weakening of the limb and may predispose to fractures from slight violence. When extensive necrosis has occurred, a slight injury may produce a fracture in childhood; this usually unites well, but in some cases union is tedious, and in others does not occur; in such cases resection and wiring is a successful operation in our experience, but if the fracture remains long ununited the

¹ Commonly known as "kitten-holder" splint.

wasting of the fragments is apt to be extreme, and in one instance the upper fragment of the humerus was so small that it was found impossible to steady it sufficiently to obtain union. Marcano has dealt with such a case most successfully by transplantation of bone (vide 'Ununited Fractures'). This bony strongly should always be borne in mind when dealing with such lesions.

Mal-united fractures, if recent, and especially if greenstick, should be refractured at once; if seen after three or four weeks, and when union has occurred, gradual reduction with splints often produces good results. Failing this, refracture or osteotomy may be called for.

Primary Amputations in children are very rarely required, and conservation should be carried to extreme limits; when amputation is necessary, if the immediate shock is got over, recovery is usually rapid. We have had once to perform a primary amputation at the hip in a child five years old for a traumatic injury, and, though there was much 'prostration with excitement' for the first two days, he ultimately did well.

Primary Resections of joints are occasionally required, and in cases of injury to the elbow are spoken very highly of by Mr. Holmes. The need for them is, however, now exceedingly rare.

Dislocations.—Almost the only dislocation at all common in children is that of the elbow—both bones being displaced backwards. This is usually said, and we believe correctly, to be more frequently met with in childhood than in adult life. Dislocation of the elbow is, however, often complicated with separation of epiphyses or fractures, and the displacement is often not directly backwards, but backwards and laterally, either inwards or outwards. Passive movement should be begun at the end of a week at latest.

Dr. W. T. Clegg, of Liverpool, has written as a case of subclavian dislocation of the shoulder, probably caused at birth; this is the only case we have seen.

Subluxation of the head of the radius is often met with in children as a result of lifting the child by one arm, swinging it round, or dragging it along. The head of the radius slips partially out of the orbicular ligament, and the arm is found to be fixed, powerless, somewhat flexed and pronated; there is usually pain both at the elbow and wrist, so that sometimes the injury has been thought to be situated at the wrist joint. Reduction is effected by steadying the upper arm, and, with the thumb over the head of the radius, rotating sharply, and then flexing the forearm upon the arm; sometimes a distinct click is felt or heard, and the power of using the arm at once returns.

We have only rarely met with a traumatic dislocation (dorsal) of the hip in children. Reduction is easy by manipulation. Dislocation of the patella is occasionally met with; there appears to be usually some congenital weakness of the part as a predisposing cause, as is the case appended.

CASE.—Dislocation of Patella.—Mary Alice N., aged 2 years 6 months; admitted February 7, 1893. History: Not strong, did not walk till three years old; seven months ago fell while dancing and dislocated the left patella outwards; since then has been constantly falling on account of the displacement recurring, especially if she runs; the injury caused her no great trouble for a week, when the displacement was noticed; was treated as an out-patient, for some time, with pads and various appliances to keep the patella in

¹ This injury has been recently described by Mr. Jonathan Hutchinson, jun., and by Drs. McNab and Lindeman, *Brit. Med. Jour.*, December 3, 1893.

pass, but without motion. On admission, the left patella during flexion lay quite on the outer side of the femoral condyle, coming back in its normal position on extension; both knees have these external condyles very prominent; on pain on manipulation or movement, the patella was immovably small and could easily be moved about from side to side; when walking it sometimes maintained its proper position, and then without warning would slip upon the outer condyle and make the leg yield. February 17, a lateral incision was made over the inner side of the joint down to the capsule, the patella pushed strongly inwards, and two circular sutures, passed through the inner edge of the patella, were tied freely down to the tissues on the inner side of the joint; operation antiseptic; limb splinted. Child has had a little pain; did quite well; antiseptic left off on March 5, and she was sent out in plaster of Paris splint on the 10th. Seven January 1894, the patella keeps its place and the knee does not trouble her. In this case the patella was apparently abnormally small and ill developed, and that probably accounts for the condition.

Subluxation of the knee has been recently described by Mr. H. H. Robinson as occurring in children about twelve months old, and apparently the result of relaxed muscles and ligaments. The tibia becomes displaced

inwards, and retained out on attempts being made to walk. Attention to the general health and friction are the only modes of treatment required, and the tendency to displacement disappears as the child grows stronger.¹

Congenital Dislocations are considered under the head of Malformations (p. 636).

Injuries of the Soft Parts in children require no special notice; if the immediate shock is got over, such wounds usually heal with great rapidity, even if very severe, and nothing short of actual



FIG. 111.—Dislocation of the Patella. A points to the displaced bone.

gangrene (Holmes) should be considered justification for amputation. Warmth, opium in small doses, and low stimulation are specially required for all severe injuries in children.

Burns and Scalds are exceedingly fatal, chiefly from shock, lung complications, and cerebral effusion. If the first few days can be tided over, recovery is usually satisfactory, and much more rapid than in adults. Careful watch for critical reaction must be kept up, and provision made

¹ *Brit. Med. Jour.* July 27, 1895.

against it by suitable extension apparatus and manipulation, as well as by grafting. Plastic operations may be required at a later date.

Shock.—The question of how children bear the shock of severe injuries or operations, and the effects of loss of blood and of pain, is one of much importance to the surgeon, and may be shortly considered here. First, then, as regards operations in infants and quite young children, the great depressing element is removed. They do not anticipate and are not cut down by the thought of the effect upon their future usefulness of any mutilation. In somewhat older children anticipation of pain is of course keen, but it seldom depresses in the same way that it does in adults. Again, the temperament of children is usually mobile, and, even if mental depression occurs, it is not long lasting. So with shock from a severe injury or operation the symptoms are often severe, even more so than in adults, for a short time; but, if by means of stimulants the first few hours can be got over, children very quickly rally. It is common to have a great amount of shock in a child after such an operation as an amputation or excision of one of the larger joints, and yet the next day the child is often as bright as if nothing had happened. On the other hand, occasionally we see 'prostration with excitement' in a severe form in children, and we have known a mental condition practically identical with acute mania coming on after amputation at the shoulder joint, and lasting for some weeks, followed by complete recovery.

Loss of blood is always very ill borne by children, and the more so the younger the child. Still, recovery is rapid if the child survives. Even the small quantity lost in a hardy operation sometimes seriously endangers the life of an infant a few weeks old, and in all cases great care should be taken to avoid hæmorrhage as much as possible. The only instance of death from amputation at the hip joint that we have had in a child was in one where, from removal of a large part of the pelvis, free bleeding took place.

Next to loss of blood we should put **cold** as having the most depressing effect upon children, and this should always be carefully guarded against by exposing as little as possible of the body beyond that part actually being operated upon.

Pain, if really severe, very seriously depresses a child, far more so than it does an adult, and many of the cases of severe harm die speedily from the combined effects of pain and fright. Hence, no child should be allowed to lie in pain after an operation, and opium should be given freely for a few hours till the first soreness has passed off, bearing in mind, of course, that opium has a disproportionately strong effect upon children, and that some children bear much smaller doses than others. The general rules, then, to be followed as to the management of surgical cases in childhood are: (1) Do not let a child know that he is going to be operated upon, until the time actually comes for the operation. (2) Avoid with the utmost care unnecessary loss of blood. (3) Keep the child warmly wrapped up. (4) Never let a child suffer pain if it can be avoided; thus, an anæsthetic should be given for any painful dressing or manipulation, and opium as soon as recovery from the anæsthetic has taken place.

As Mr. Holmes has well pointed out, in children 'irritability is chiefly directed against sudden and acute pain; but confinement to bed and protracted disease, which wear out the patient and exhaust the hopes of

older persons, soon become customary in childhood, and then produce little impression.' As Mr. Holmes shows, freedom from mental depression and healthy, unimpeded excretory organs probably account for this difference.

Children are, of course, liable to the same **septic diseases** as adults, and pyæmia is, though happily rare in both, quite as common in childhood as in older patients. Diphtheria, and especially scarlet fever (vide Chap. XIV.), are very apt to attack surgical cases among children, i.e. those in which there is a wound or a local inflammatory focus, while erysipelas, though not very rare and occasionally fatal, is mostly of a mild type in children, and in our experience the so-called 'erysipelas vagans' is the variety most commonly met with. See, however, *Vaccination Erysipelas*, p. 261.

'Surgical scarlet fever,' so called, is nothing more than ordinary scarlet fever. It is now well known that children who have open wounds, who have been recently operated upon, or who have local inflammatory foci, such as abscesses, are specially susceptible to scarlet fever. For further details and references we must refer to papers by Dr. Goodhart and Messrs. Howe and Paley, in the *'Guy's Hosp. Repts.'* for 1879, and to an account of an outbreak in our own surgical ward, by R. W. Murray, in the *'Brit. Med. Jour.'* June 18, 1887.

No special remarks are required upon the subject of dressing wounds in children; the same rules should be followed as in adults. We use antiseptics—chiefly boracic and mercurial lotions, with iodoform and ultimate wood-wool wadding—and are fully satisfied of the value of these agents. Mercurial poisoning in children we have not certainly met with, and only iodoform poisoning in a few instances, and those of a very mild type. We have twice had a fatal result follow within twenty-four hours of emptying and washing out a large abscess, but we have been unable to connect the death definitely with the use of any particular antiseptic agent, though we have suspected perchloride of mercury of being dangerous in such cases.

In certain cases—for instance, in circumcision—it is well to avoid the thought of a second manipulation by the use of catgut sutures in closing the wound, and it may be remarked that primary union of wounds in children is much more easily obtained than in adults, provided the child is healthy and not too young; in the very young the tissues are too soft to bear any strain, and in childhood the very slightest disturbance of health is sometimes enough to prevent union of a wound; hence all plastic operations should be performed only after careful inquiry into the child's general condition. The same slight causes will then produce a temperature chart that would be very alarming if it were not known how little is required to raise a child's temperature. As to the dieting of children after operations, it will be found that children can without harm much more speedily return to their ordinary diet than can adults, and it is common for a child to resume its usual food the day after an operation.

We have two or three times met with cases of persistent vomiting after operation resisting all treatment and even proving fatal by exhaustion. In one instance, after operation for cleft palate, the vomiting was followed by purpura, gangrene of the extremities, endocarditis, and death from acute septicæmia.

CHAPTER XXXVII

ANÆSTHETICS FOR CHILDREN

By ALAN WILSON, Esq. F.R.C.S.

BOOK ADMINISTRATION IS CONFIDENTED TO THE MANCHESTER SMALL PUBLISHERS, LTD.

As regards anesthetics, children come under much the same rules as adults; they are in general better subjects, in the sense that they are less often the victims of those degenerative changes which in adults complicate the administration of anesthetics. On the other hand, as they respond so readily to the action of anæsthetic agents they always require cautious handling. In addition to their greater freedom from degenerative changes, children from the anæsthetist's point of view differ from adults in certain particulars. Chief amongst these is their capacity for inhaling an anæsthetic. Children possess highly expandable chests, with a proportionately large lung area; in proportion to their weight they probably have greater "vital capacities" than most adults, at least than those who lead sedentary lives. They have more available active lung space to absorb the anæsthetic. As a consequence of this relatively large vital capacity they can readily take in and absorb a large dose of any anæsthetic vapour, which explains the quickness with which they become insensible. We have seen a struggling child reduced to an almost lifeless condition by one deep inspiration of a concentrated chloroform vapour. Again, the crying and struggling often attending their taking of the anæsthetic make the inhalation of it jerky and irregular and more difficult to regulate.

The highly developed condition of the reflexes of children constitutes another difference in their behaviour under an anæsthetic. Thus they will exhibit movements during an operation, while an adult under similar conditions and in the same degree of narcosis would remain quiet. A child, though moving immediately before the termination of an operation, will often be long before it regains consciousness after the operation, though little or no more anæsthetic has been given. In the same way, the reflex for the act of crying is well developed in children, so that during an operation they will often give a cry at a stage of narcosis in which an adult would either exhibit no sign of feeling at all, or merely move slightly. They do not necessarily perceive or remember the painful sensation. For example: occasionally a child will emerge shrieking from the narcosis of nitrous oxide and yet not have any painful impression, or the slightest idea why it is crying.

This readiness with which children cry has led to the belief that they 'come out' of chloroform quicker than adults.

The reflex spasm of the glottis from the irritation of an operation, after well seen in adults when the splinter nail is dilated, is readily produced in children, even when they are well 'under.' It is most frequent in operations involving the urinary organs and anus, and while the bladder is being distended, and is occasionally so great as to interfere with respiration. It is relieved, but not entirely removed, by extending the neck, pushing forward the lower jaw, and by giving more of the anæsthetic. It is very rarely necessary to pull out the tongue with forceps.

Children are very susceptible to shock, and no suddenly painful procedure (e.g. wrenching a joint) should be undertaken when they are in a semi-anæsthetic state. Though the occurrence of reflex paralysis of the heart has been denied by certain recent observers (Hyderabad Chloroform Commission), we have seen one case (a young girl) in which death was clearly due to shock produced by flexing a limb when the patient was not completely under the influence of the anæsthetic.

Local Anæsthesia for exploratory punctures may be produced by holding a piece of ice dipped in salt against the surface until it is frozen, or by the ether spray or by ethyl chloride.

Cocaine, from the method of applying it, from its irregular action and the unpleasant symptoms it sometimes causes, cannot be much used for children.

Nitrous Oxide is well borne by older children and may be always used in dental operations. It might be employed with advantage in many minor operations, as its transitory effects can be made more prolonged by repeated administration, when free access to the mouth is obtainable, or the admixture of ether with the gas may be used. Children go quickly under the influence of nitrous oxide, and the period of anæsthesia is shorter than it is in adults; they also exhibit a greater degree of spasms, opisthotonos often being well marked—a point to be remembered, as it may be a disturbing element. The combination of oxygen with nitrous oxide is especially useful in children; it greatly diminishes the spasm and untidiness, and slightly prolongs the anæsthesia. The same effects can as conveniently be produced by giving a little ether with the gas.

Chloroform, in the case of children, is not quite the safe and dependable anæsthetic it is often represented to be. Altogether, a fair number of deaths from it have been recorded, and many more unpleasant, though not fatal, accidents have occurred with it. Children possess no special power of resistance against the lethal action of chloroform or any other anæsthetic. The youth of the patient is a source of safety only, because it implies a greater freedom from disturbing degenerative changes in the nervous, circulatory, and respiratory systems. With chloroform it is very easy for the patient to take an over-dose; it generally causes some cardiac depression, which may be of an alarming character, shown by pallor and lividity of the face, and feeble pulse—frequently before the operation has been commenced. The after-illness sometimes continues a long time. As a rule, the sickness and faintness at the end of the administration are greater in children than in adults. Even after a trivial operation there may be to an unpleasant degree

a feeble pulse, cold clammy skin, &c., so much so that this has led certain surgeons to employ ether as the routine anæsthetic for children and chloroform for adults. Chloroform is contra-indicated in operations for spina bifida and hydrocephalus (Morton). It is recommended by Horsley in cerebral surgery; this administration to be preceded by a hypodermic injection of morphia.

Ether compared with chloroform is less depressing; the pulse continues strong throughout; the face keeps a good colour; the tendency to syncope is diminished, and the after-sickness is of shorter duration, often arising when once the stomach is emptied of mucus. It is quicker in its action consistent with safety, so that the distressing struggles of a child can be speedily ended without danger, in a way that could not be done with chloroform. The risk of suddenly giving an over-dose is almost nil. Ether, however, has disadvantages; it requires some apparatus for its proper administration, it occasionally causes considerable secretion of mucus, and when given alone it is unpleasant. The last of these objections can be overcome by giving it in combination with nitrous oxide, or by first giving a little chloroform. The secretion of mucus in children is no greater than it is in adults, and only in the minority of cases is it enough to give any trouble. When it is excessive it may readily block up the small trachea and bronchial tubes and give rise to inconvenience, especially if the patient is kept deeply narcotised. In these cases changing the anæsthetic to chloroform does not immediately improve matters, as the change does not remove the mucus. It is better to allow the patient to recover consciousness enough to clear the lungs by coughing. Ether is contra-indicated in lung disease, and is supposed to be dangerous in kidney diseases.

The A.C.E. Mixture is a weaker anæsthetic and not so depressing as chloroform, and so safer; but it is not as safe as ether.

Bichloride of Methyl presents no special advantages over the above-mentioned agents.

The Choice of an Anæsthetic.—On this point too much stress must not be laid upon the mere question of age; extreme youth does not necessarily contra-indicate the exhibition of ether, nor make imperative the use of chloroform. Though inhalers are not made to fit infants, if considered necessary, ether can be given on list, or the narcosis produced by chloroform can be kept up by ether. Roughly speaking, chloroform is best for children under five years; it is also the hardest anæsthetic for older children; but ether is certainly the safer. For those who desire to employ an agent between the two in lethal capacity the A.C.E. mixture presents itself as a convenient medium. If it is thought advisable during narcosis to change from ether to chloroform, care must be taken that an over-dose be not given, as the deep respiration and full pulse produced by ether make very easy the inhalation of a fatal dose of chloroform. This fact, long ago proved by clinical experience, has been recently well illustrated by the experiments of the Hyderabad Chloroform Commission.

Preparation.—If possible, an anæsthetic should not be given within three or four hours of a meal. As children bear badly the deprivation of food, any longer interval, besides being unnecessary, is injurious, making the patient feel faint. A feeble child, or one kept long without food,

should be given some liquid nourishment, some little time before operation.

In every case it is well to have at hand chloroform, ether, and A.C.E. mixture; the administrator should also have a plentiful supply of lint, tongue forceps, a hypodermic syringe, nitrite of amyl capsules, sponges and an electric battery, and a mouth gag with a sponge-holder. These latter are occasionally required in cases of vomiting.

Before beginning the administration, examine the mouth for any loose temporary teeth which might become detached, especially if a gag is to be used, and also in better-class children for any dental regulating plates; avoid, if possible, alarming the patient, for with a struggling, crying child the danger of giving an over-dose is increased. By a little tact most children can be anesthetized without any crying, even when inhalers are used. If the child is nervous, let it sit on its mother's or nurse's knee. If it is not undressed, don't have it undressed until it is 'under,' then it can be done without alarming it. Let it see the inhaler or lint, and smell it before any anesthetic is put on. During the administration, when the smell is objected to, induce the patient to 'blow it away.' It is not absolutely necessary that the child should be lying down in the early stages; if quiet can be gained by letting it sit up, let it do so. These small details are of importance, as there is no doubt that to a highly sensitive child the struggling and shock of being choked off by an anesthetic may have injurious after-effects. Should the child cry, go on steadily with the administration, but do not give an *extra* quantity or 'push' the anesthetic to get it 'under' the quicker. As it is breathing more deeply than normal, rather put less of the anesthetic in its way, and so avoid all chance of the sudden inhalation of an excessive dose.

Ether is best given with a Clover's inhaler; it should be administered slowly; if the child struggles and becomes unmanageable, it is allowable to turn it on to 'full' and get it under quickly. In giving gas and ether, Hewitt's modification of Clover's inhaler is the most convenient. Very little gas is required, and the ether should be turned on before any spasm sets in. When the patient is once 'under,' only a small amount of ether is needed to keep up narcosis; a strong ether vapour causes an unpleasant amount of mucus to be secreted.

Chloroform is most conveniently given on lint. First put a little vasoline on the face to prevent blistering; place the fold of lint over the nose and mouth and then gradually drop the chloroform on it; when the patient objects, coax him to 'blow it away.'

It is a good plan, standing on the patient's right, to hold the lint on the nose with the left thumb and forefinger, pressing on the nasal bones, while the third and fourth fingers spread over the forehead, feel the pulse of the anterior temporal artery, and steady the head; the right hand is then free to drop on the chloroform and control any nervousness. In dropping the chloroform hold the bottle near the lint; if it is dropped from a distance, it is extremely easy for a little to get into the eye.

Hold the child as little as possible. If it sees the lint, quickly replace it with a fresh piece rather than waste time struggling for the first; then try with chloroform to 'read it over quickly.' Each inspiration means one dose

of the drug, which takes effect some seconds after its inhalation, therefore remove the list at the first sign of anaesthesia, or the patient will get several unnecessary doses. The quickness with which children become unconscious has been referred to. Should there be coughing, in the deep inspiration following the cough, do not let the patient inhale too much chloroform vapour, and be careful not to mistake the general jerking of the limbs caused by the coughing for voluntary movements requiring more chloroform. It is occasionally difficult to entirely abolish reflex movements during an operation on the skin, and the anaesthetic must therefore not respond too readily to the 'More chloroform, please,' of the operator.

Spasm of the glottis with crowing inspiration is very common, especially if the patient is not quite 'under,' or is beginning to have nausea; it is generally a sign of imperfect anaesthesia, and when accompanied by such signs as rigidity of the jaw muscles, contracted or slightly dilated pupils, and a good pulse, is an indication for more of the anæsthetic; the spasm is partly relieved by pushing forwards the jaw with the neck hyper-extended; as previously remarked, pulling out the tongue with forceps does not remove the spasm, it is rarely necessary, and should be avoided as much as possible, as being liable to cause unnecessary after-pain in the shape of a sore tongue. If it is considered advisable to keep the tongue drawn out, it should be gently held out with a pair of tongue forceps, or, better still, by the fingers and a piece of lint. The lower jaw can be conveniently held forwards by using the closed forceps as a lever, the upper teeth acting as the fulcrum.

During the administration the same rules should be observed with children as with adults.

Vomiting, if the stomach is empty, can be overcome by giving more chloroform, otherwise it is better to suspend the administration until the stomach has been emptied, and then to resume it; turn the patient well on one side during vomiting, and keep the mouth and pharynx clean. A patient with a loaded stomach will breathe badly, have stertor, and present a more or less cyanotic appearance. Frequently the vomiting will be preceded for some time by a condition in which the patient presents a feeble pulse, irregular, stertorous, or spasmodic respirations, and more or less cyanosis, which is improved when once actual vomiting begins. The corneal reflex is an uncertain index of the state of general anaesthesia: it may be absent from one eye while it is present in the other; it will often be present throughout an operation while the patient presents no other indication of sensation, and it may be absent in both eyes and yet the patient will vigorously indicate that sensibility to operation is present. In the latter condition it has been suggested that the chloroform vapour exerts a local anæsthetic influence on the conjunctiva. A good deal depends upon the painfulness of the operation; therefore, as a test of the sensibility or degree of narcosis, the corneal reflex must be considered in conjunction with other symptoms and conditions. Thus, the corneal reflex being absent in both eyes, a deficient degree of anaesthesia (narcosis) will be indicated by some or all of the following symptoms, which serve to check the inferences derivable from the cornea, viz. contracted pupils, slight movements of the lips, modification of the facial expression, rigidity of the masseters, alteration in the rhythm of the respirations or increased rigidity or spasm of the glottis, and movements, chiefly

extension of the fingers or occasionally momentary dilatation of the pupils when a sudden pain is felt.

The condition of the pupil taken by itself is also not of much help as an indication of the stage of anæsthesia. It generally dilates to a varying extent during the first stage, widely if there is struggling; it may remain widely dilated throughout the administration, even though the narcosis is well deep, and the corneal reflex may be present with a widely dilated pupil.

Generally the dilatation gives place to moderate constriction after the operation has been commenced. The onset of sickness is accompanied with a dilated pupil, and shock causes wide dilatation of the pupils. In noting the corneal reflex do not hold the eyelid up in a way that prevents it closing, as it occasionally does. Should there be a return to consciousness during an operation, the administrator must be careful not to 'push' the anæsthetic too freely, and must not go straight on giving the anæsthetic until the patient is quite quiet again, but must watch the effect of each dose (i.e. inspiration). The unsteady condition of the patient at this stage and the irregularity of the respirations, which are generally deeper and quicker than normal, make it an easy matter to give an over-dose. There are several fatal cases on record which prove the need for caution under such circumstances.

When once the child is 'under' it is very important to avoid moving it suddenly or roughly; such treatment tends to cause syncope. This caution is especially necessary if there has been any loss of blood or there is faintness. Under these circumstances never allow a patient to be raised up into a sitting or semi-sitting position for the putting on of dressings. This can easily be avoided by drawing the patient to the end of the table and supporting the body so that the head and shoulders project beyond the table; full access can thus be gained to any part without in the least raising the patient. We have seen a serious attack of faintness brought on by the sudden raising of the head and shoulders of a child at the end of an operation in which a considerable amount of blood had been lost.

In connection with this it is important to remember that for the respirations are not always associated with shock. One of the most serious symptoms of cardiac and general failure is deep, gasping respiration accompanied with a quick running pulse. If, in a patient undergoing a severe operation, ordinary quiet respiration suddenly gives place to deep inspirations, especially if they are of a gasping character, associated with a quick pulse and dilated pupil, it is a sign of serious if not fatal syncope. This is not as common in children as in adults, but it occurs in them under similar conditions. It is due to stimulus of the respiratory centre, whether caused by actual loss of blood or cardiac failure.

Anesthetics in Special Operations.—There are practically no conditions under which an anæsthetic is contra-indicated; if an operation can be performed, an anæsthetic can be given. A few operations require special notice.

In Tracheotomy an anæsthetic, though not absolutely necessary, is a distinct advantage, especially where it is desired to clear membrane from the trachea. The danger that it might set up fatal spasm can be avoided by giving it gradually in a dilute state and by delaying the administration until the operator is quite ready. As preparation for any emergency, it is

well to arrange the patient on a definite plan, e.g. on the back, with the shoulders and back of the neck supported by one firm pillow and a second smaller one under the occiput. In the event of a sudden spasm and cessation of respiration demanding immediate operation, by pulling away the second pillow the head at once drops backwards, making prominent the trachea without any lifting of the patient. This plan, though most useful in dealing with heavy adults, is equally valuable in children.

Operations on the Mouth.—In all operations on the mouth or pharynx it adds materially to the chloroformist's comfort, and to the patient's safety, to have the patient's head hanging downwards: either hanging over the end of the table, or with the neck so extended over pillows that the vertex of the head rests on the table. This position keeps the larynx quite free from blood which, while it is fluid, will escape through the nostrils. A damp towel or lathing cap should be fixed around the head to keep the hair from being soiled.

As regards anesthetics, the fact that the operation is one involving the mouth or throat does not in itself confine the anæsthetic to chloroform. Mr. Warrington Howard has shown that ether may be used in the operation for cleft palate, and we are constantly in the habit of giving ether in post-nasal adenoid growths.

In cleft palate, chloroform is the most convenient anæsthetic: it should be given on lint until the patient is 'under,' and then the administration continued by Juske's inhaler; by which means the operator can work continuously without being interrupted by the chloroformist.

In the operation for post-nasal adenoid growths, an anæsthetic (gas and ether or chloroform) should always be given. The patients are longer in going 'under' from the interference of the adenoids with respiration, but that is all. If the head is allowed to hang downwards, the free hæmorrhage is never any real trouble. In laryngoscopic examinations, chloroform is useful for abolishing the fear of the patient; but it will not always cause sufficient anæsthesia to permit of the larynx being manipulated through the mouth. In one case of laryngeal polypus in a child aged six years, under the care of Dr. Harris, we utterly failed to produce anæsthesia sufficiently deep to permit the polypus to be removed by the mouth, even by combining the cocaine spray with the chloroform.

In suppurative cases chloroform is best. Care must be taken not to produce coughing by giving it too strongly at first, and the child must not be turned to the sound side.

In cases of trephining the spine, chloroform should be given. The best plan, especially if there is paralysis of the intercostals, is to turn the patient right on to the face and support the body on pillows in the following way: the anterior iliac spines rest on a firm sand pillow, an ordinary thin pillow supports the chest, and the forehead rests on a small firm sand pillow. By this means the operator gets free access to the spine, the abdomen is not pressed upon and the diaphragm has full play, while the mouth and nose are supported some distance from the table, and the chloroform list can be slipped under the nose as required; any secretion flows easily out of the mouth.

Operations on the Bladder.—In these cases it is important to have the

patient "under" before injecting the bladder is begun. If this is neglected, the manipulations will most likely set up spasm of the glottis and straining, which will impede the inhalation of the anesthetic and delay the production of anesthesia.

Accidents are of a similar nature to those which occur in adults, and should be treated on similar principles. As examples of the various kinds of accidents, may be quoted cases in which an attempt is made to speedily anesthetize a crying child, with the result that it is allowed to take several deep inspirations of a highly concentrated chloroform vapor, and so obtains a sudden over-dose; in other cases where it is desired to produce deep anesthesia the dangerous symptoms may be initiated by some sudden movement of the child when it is deeply under. We have seen two cases of this class when the patient was deeply narcotized for the operation of cleft palate; the sudden raising of the patient produced symptoms of syncope. In unprepared patients the embarrassment of respiration caused by a loaded stomach and the onset of vomiting gives much trouble. The patient breathes with difficulty, has spasm of the glottis, becomes pale and slightly cyanosed, has a feeble pulse, etc.; most of these symptoms are relieved by vomiting.

In the treatment of accidents it is well to remember that heat is a powerful cardiac stimulant, and a hot sponge placed over the heart is better than slapping the chest with a wet towel. When the windows are thrown open in a case of shock, care must be taken to keep the patient covered and warm. Artificial respiration must be done quietly and efficiently. Intermittent pressure over the heart, as recommended by Schleichberg, is useful in cardiac failure; and inhalation of nitrite of amyl in cases of engorgement of the right side of the heart.

The battery is useful only as an aid to artificial respiration, by faradizing the phrenics. Unless this can be effectively done it had better be left alone and reliance placed upon ordinary artificial respiration. In cases of shock after long operations, inhalations of oxygen are highly recommended. Of this we have had no experience.

Subcutaneous injections of ether, though they are strongly condemned by certain authorities, in some cases do seem to do good. Of course, if the patient has been taking and is already saturated with ether, it would be useless to give more.

APPENDIX

DIPHTHERIA.

Serum-therapy—Antitoxic treatment of diphtheria.—The attitude of the American profession at the latest amount of scoring of this edition justifies a stronger statement of the value of the antitoxic treatment. The following is extracted from a recent article summarizing the present status of diphtheria antitoxin treatment, by Prof. W. H. Welch.* Antitoxin acts through the agency of the living body, rendering the cells competent of the toxin. The cells must therefore be in a condition to respond in the proper way to the introduction of the antitoxic serum. The toxins of the diphtheria bacillus are most powerful poisons of cells; the result being cell death. There is no way of determining by tests the extent of damage the cells may have already sustained. There is some evidence in favor of the view that while antitoxin may exert its protective action upon certain groups of cells, other cells, as for example the nerve-cells, may either by their nature or on account of certain influences, not be wholly protected against the toxin. Paralysis (post-diphtheric) may occur in cases treated with serum, where early treatment has been practiced and with favorable results upon the faucial diphtheria.

"If the benefits of antitoxin are statistically manifested in those operated cases of croup than the test is an *experimental crux*." In comparing reports of previous or simultaneous fatalities from tracheotomy, taking the lowest figures, there was an apparent reduction of 34.1 per cent. by the serum treatment, and from intubation an apparent reduction of 44.4 per cent. from serum treatment. Finally, the fatality of 3,127 non-operated cases was only 11.4 per cent. with the serum treatment.

"In twenty-four to forty-eight hours after the injection the general condition of the patient is remarkably improved in the great majority of those patients who were in a condition to be benefited at all by antitoxin. The general improvement is accompanied by a fall of temperature, which may be a critical fall, especially if the disease is not far advanced; often it is by less. . . . Accompanying the fall of temperature is improvement of the pulse in frequency and tension, but the heart's action may for some time, even into the period of convalescence, remain weak. In the favorable cases the local diphtheritic process is arrested.

*Transactions of The Association of American Physicians, also "Bulletin of The Johns Hopkins Hospital," July-August, 1894, also reprint, etc.

usually within the first twenty-four hours after the injection. . . . The area covered by membrane becomes sharply demarcated, and the swelling of adjacent mucous membrane disappears. . . . Nasal discharge is lessened. The swelling of the glands in the neck, and the surrounding edema disappear, in far as these are not referable to secondary infections."

"The principal conclusion which I [Dr. Welch] would draw from this report is that our study of the results of the treatment of over 7,000 cases of diphtheria by antitoxin demonstrates beyond all reasonable doubt that anti-diphtheritic serum is specific curative agent for diphtheria, surpassing in its efficacy all other known methods of treatment for the disease. It is the duty of the physician to use it."

The antitoxin serum should be secured from a reliable source, should be chemically sterile, and strong in antitoxin. It should be kept in a cool place.

The dose in a given case should be estimated primarily by the extent of the local lesion and severity of the constitutional disturbance, secondarily by the age of the patient and the stage of the disease. In a young child, with a small exudate upon the tonsils and the parts immediately adjacent, a single dose of 500 c. c. Behring's standard No. 2 solution, or 15 c. c. of a 1 to 30,000 solution from any other source, may be sufficient. For older children and adults 1,000 units is a proper dose. In cases of pronounced severity, or where toxic effects are already present, or when the diphtheritic process has invaded the larynx, a full dose of 1,500 to 2,000 units, 10 to 15 c. c. No. 2, should be substitutively administered. If improvement in the symptoms is not observed on the following day, 1,000 to 1,500 units should be given. Occasionally a third injection is necessary. If, as occasionally happens, after a few days a moderate amount of diphtheritic exudate reappears in the pharynx another injection is indicated.

For injecting the antitoxin serum a large hypodermic syringe, holding from 15 to 20 c. c. is usually employed. Special syringes are made for this particular use. Their main recommendations are that their size is sufficient to hold the maximum dose, the packing is of such material, notably asbestos, various compositions, or remorable rubber, as to allow either of boiling the whole instrument without removing the piston or of easily sterilizing and freely washing both piston and packing. The usual precautions as to syringe and skin that hold in ordinary hypodermic injections, are considered safe. The injection should be made into the loose subcutaneous tissue, not into the muscles, the usual site being a short distance below the nipple on one or both sides according to the size of dose administered. The skin immediately after an injection usually bulges forward forming a prominent swelling, but the serum is quickly absorbed and it is better not to employ massage to facilitate its absorption. A strong needle, rather long, not too large, is best for the purpose. As a rule there is but little pain following an injection, though there is occasionally some tenderness for a few days. With proper serum and ordinary precautions no abscesses should follow.

Cleansing the Throat.—All other rational methods of treatment of diphtheria should be added to that of antitoxin—cleansing the throat especially.

In the condition of sloughing, foul-smelling tonsillar and faucial diphtheria, solution of hydrogen ("fifteen volume" whole strength or diluted with equal quantity of lime-water) serves a useful purpose. For moderate cases it is to be recommended

with great caution, for too energetic treatment may easily cause injury to the healthy mucous membrane, as pointed out by Sasaki.

Another very good method is the following: Syringe the throat first with pure water, to accustom the child to the practice, delivering a gentle douche which will flow readily from the mouth. Next, depress the tongue gently and syringe again while the child has learned its use. Gradually the force may be increased until a sharp jet is thrown well back into the throat, any desired medication being added to the water.

A hard rubber piston-syringe of four-dram capacity or more, capable of being easily entered with one hand, is best. The nozzle should be short, passing just within the teeth, so as to avoid injury to the parts. In young infants this method works well, and if carefully used allows some of the fluid to be swallowed. After the throat is well cleaned corrosive sublimate solution, one part in 5,000 up to one part to 2,000, may be used, this being the most efficient disinfectant. There are to be preferred to all other methods of throat cleaning and disinfection. It is desirable not to use corrosive sublimate in such strength as will cause marked irritation lasting more than a minute.

Intubation.*—The views expressed on page 107 are not so favorable as those prevailing in America, Germany, France, and Hungary. Intubation is capable, in the hands of a skilled operator, supplied with the proper sizes and shapes of tubes, of meeting all emergencies which the advocates of tracheotomy claim for the cutting operation. This was true even before the adoption of the autolysis treatment of diphtheria. The points to be specially considered are:

When no update.

216

How to remove the tube.

33

Impacts and difficulties of openness

10

10

Figure 1

writing

000000

10

www.oxfordjournals.org/doi/10.1093/oxfordjournals/...

2000

to become unaided, when the labored breathing begins to produce visible exhaustion, assistance is to be performed promptly.

How to Open.—Wind the child from chin down in a tight blanket, shoulders, arms and hands included. Pin the blanket closely about the neck, and yet do not make a bulky roll so interfere with depressing the inflexible handle. In this way the elbows are pinioned to the side and the hands are held across the child's abdomen.

The nurse sitting upright, not leaning back, should grasp the child's elbows firmly, outside his winding blanket, of course, and clamp the child's legs between her knees, making sure she turns her own about the legs of the child. Some prefer to stand the child across the nurse's lap, the little nurse clamping her arms

* Extracts from a paper read by the American Editor before the British Medical Association, Bristol, England, June, and published in *Am. Med. Journal*, Dec. 25, 1906.

about its knees. All these precautions are to secure the child in a firm grasp, so immobilize it without interfering with the expansion of its chest, and may be taken without causing any apprehension or excitement. *The position of the child should be so changed it hangs from the top of its head.*

The physician assisting should stand behind the chest of the nurse, grasp the child's head between his hands, hold it firmly, and when the gag has been inserted enclose it within his grasp to insure its firmness and steadiness. The operator, seated or standing squarely facing the child and nurse, inserts the gag, opens the mouth widely, and gives the handle into the keeping of the assistant. The introducer, armed with the proper-sized tube, is supposed to be detached and at hand.

Next he inserts his index-finger, hooks up the epiglottis, crowds its bags to one side, passes the tube past it till it engages in the stalk of the glottis, elevates the handle, gently passes the tube down till the head is within the larynx and the introducer has crowded upon the tongue. He then, with the trigger, lowers the alarinas, holds the tube with the left index-finger while withdrawing the alarinator, and with a gentle thrust presses the tube's head well into the larynx and removes the finger and gag. Just here let me emphasize what is stated above—*keep the introducer in the middle line*; otherwise the alarinator will push in the cul-de-sac of the tube and drag the tube with it as it is withdrawn.

The handle of the introducer should be held most lightly between the end of the thumb and the fingers. In this way it is impossible to use enough force to make a false passage. The lines and angles must be maintained to insure quick intubation. If on the first attempt the tube is not successfully placed in the larynx it is better to make repeated short attempts than pushing one.

Having placed the tube in the larynx, there will be rattling in the tube on first respiration and subsequent cough and expectoration. A vigorous cough stops well for the steadiness of the parts, and for evacuation of accumulations below. The gag is removed as soon as the tube is in place, but not so the throat; it must remain till it becomes evident that all obstruction to breathing has been overcome, and no partially detached false membrane is in the tracks below the tube. The throat at first acts as an irritant to cough, which is desired; *continually*, ten minutes are sufficient time.

How to Elevate the Tube.—Place the child in the position for intubation as described above. Thrust the left index-finger past the epiglottis, hook it up, and the tip of the finger upon the two arytenoid cartilages and carry the extractor point to the end of the left index-finger at the pulpy portion generally regarded as the most delicately tactile. The situation is then as follows:—The finger tip upon the arytenoid marks the posterior boundary of the glottis in the median line. Now, if the extractor point be carried along the median line to the end of the finger and the handle be elevated, the point will naturally be guided forward from the end of the left index-finger on the arytenoids, into the aperture of the tube. Occasionally cases are found in which the epiglottis hangs so closely the head of the tube that it is very difficult to raise it and keep it out of the way. This is liable to occur, especially in screaming groups in which the epiglottis is not always involved in the diphtheritic process. In such cases the extractor would be guided behind with the left index-finger at the side, as in intubation. The guard series of the

extensor-lever should be carefully set to avoid injury to the tissues in case the extensor-jaws should be opened by mistake in the soft parts instead of in the tube. Many operators, both in Germany and America, leave the thread stretched throughout the whole time, and occasionally a tube is coughed out after the swelling releases its grip. So in actual experience one is not called upon to extract as often as to intubate. The fact remains that extubation is more difficult.

When to Remove the Tube.—This depends on the age of the child and duration of the disease before intubation became necessary. The older the child the earlier the tube can be dispensed with. Estimating the maximum of the disease to be seven days, five days' wearing the tube is considered, on an average, sufficient. The use of antiseptics has diminished the time of wearing of the tube to forty-eight and often twenty-four hours.

Dangers and Difficulties of the Operation.—In the hands of an experienced operator there are practically no dangers to life at the time of operation.

A few authentic cases of pushing down membranes before the entering tube have been recorded. Expert intubation according to latest practices presupposes that the thread has been left attached, and therefore easy immediate removal is possible. This experience with loose pseudo-membranes occurs more often late in the disease, and in recrudescences.

In the inexperienced there are many dangers: (1) asphyxia from prolonged attempts; (2) laceration of the parts, false passages, etc. The explanation easily given to these two most common accidents is "pushing down false membranes." So called apyral attacks are simply lesser attacks of asphyxia. Convulsions are recorded, and instruments have been broken in intubation.

An experienced operator may encounter two difficulties:

1. The point of the tube may enter one of the ventricles of the larynx. This is not unusual, for the original disease usually fills and obliterates these cavities. Such obstruction, however, does occur. It may readily be seen how an inexpert, one that has tube and handle were exactly in the middle line, might drive his tube into the tissues of the neck. He certainly has but to remember the cardinal points of advice, and he will use most gentle pressure; he need but look at the light introducing instruments to appreciate that they are for delicate work.

2. The second difficulty or obstruction that an experienced operator may meet in intubation is subglottic stenosis—or what is so often described as "edema." The narrowest part of the respiratory ways is the cricoid ring. This fact, so far as I know, came to light for the first time in Dr. O'Dwyer's early investigations in intubation. If the head of an intubation tube be tightly crowded down from above, it may pass the vocal bands, and yet exert all effect at the cricoid ring. Given a resisting cartilaginous ring lined with mucous membrane, we have the very elective conditions for stenosis. Fortunately, the swelling and infiltration are not often extensive enough to cause serious obstruction, but may be. Operations come upon cases where the properly selected tube barely passes into the larynx, and yet encounters resistance—even "creeps back," as someone says, "like an oiled cork in a bottle." If one is sure of the diagnosis, and a proper size fails, a smaller tube may, with moderate pressure, be introduced. This is the only condition where force is justified in intubation.

In short, to allow the expulsion of loose membrane from the trachea, the largest possible hollow cylinder is passed through the narrowed larynx, allowed to remain for a little, and removed as soon as the rattling cough has expelled the foreign body requiring its insertion.

2. Ulceration from too large a tube swelling pressure within the cricoid ring, and ulceration at the lower end of the tube. The former can be of a serious nature, destroying the cartilage; the latter is superficial and of little import. Ulceration within the cricoid is due to improper size; ulceration below to improper construction of tube.

Properly constructed tubes are difficult to describe, more difficult to secure from a maker, even if a most faithful and conscientious servant. But one maker in this world has succeeded in making tubes that embody all the ideas of the inventor.

Feeding an Intubated Patient.—There is one disadvantage after operation: feeding is difficult. The larynx is raw. Many times it is worse because of the interference of the operation. The less the larynx is touched in intubation, the less the child will dread the clasp of the pharyngeal muscles in the act of deglutition. The fact remains that there is more or less difficulty in swallowing, both from pain and cough. The latter arises from fluids entering the trachea, though many patients acquire the accomplishment, and learn to swallow very well. The method of feeding adopted by Dr. Canbyberry, of Chicago, has very much relieved the situation. The child is inclined, head down, so that it swallows up-hill, and any fluid that may get into the tube on the act of deglutition quickly gravitates out again. The directions are as follows:—Place the child across the nurse's lap, bend the head well down, and feed either with a spoon or through a nursing bottle. At first these patients object, but when they learn that by so doing they can swallow without coughing they give no further trouble.

Medication can be continued after intubation as well as before.

Danger of Removal and Thereafter.—If the tube is removed on the fifth day in a case having an average fair course, there is little or no danger. The operator should remain half an hour. If in this time there has been coughing and clearing of the throat and trachea and no loose pseudo-membrane remains, and no dyspnea, there will be no sudden great necessity of rapid intubation. Even yet it is deemed desirable to be within easy call for some hours.

I once considered I had on an average four hours' heavy, but exceptionally prompt aid was needed sooner, and a few cases needed reintubation twelve and twenty-four hours afterwards. Whether pressure removed, the mucous membrane becomes quickly congested, or whether mucous spasm sets in, or membrane reforms, I know not, but I have learned to repeat the emergency of the first twelve hours after removal of the tube, especially if it be a premature removal.

Retained Tube (Laryngeal Canker).—Rarely it is necessary to reinsert a tube many times. The child may get along half a day or two days and yet require the reintroduction. If the tube is not of proper anatomical conformity it may cause granulations about the head. To relieve this and cure the condition, a special tube has been devised, moving a prolonged or built-up head. (See Fig. 190.) It sits above and exerts pressure upon the granulations, with consequent absorption.

Finally, not to recapitulate the literature of the subject, I may mention advantages. *First of all, parents will consent.*



FIG. 100.—Built-up head for tracheotomy.

It is a bloodless operation: no cutting, no anæsthetic, and this means much to the friends. It is quickly performed, requires no trained assistants or trained attendants (it is trained operators that are needed). The air inspired is warmed and moistened through natural passages. Results are equal to or rather better than those of tracheotomy under similar circumstances, whether it is trachea or outside.

Finally, since the successful employment of mitralia treatment in diphtheria the average duration of laryngeal stenosis has been so shortened that there seems no longer any ground for continuing as to which is the preferable method of lifting past the urgent symptoms of dyspnea. As Professor von Kienle, of Marick, proclaimed to the British medical profession in London, "the time has come when it should be upon a man's conscience to leave a scar upon a child's neck, for, with the employment of healing serum there remains no excuse for tracheotomy in diphtheria."

GENERAL DISEASES.

Scurvy.—The American cases, about 200 thus far reported, do not convey the conclusion that there is any necessary connection between rickets and scurvy. They are frequently associated, but in a majority of cases of scurvy there is no evidence of rickets. The first recorded case in American literature had a fatal ending and a complete anæsthesia. This case was under the observation of the writer; the post-mortem studies and reports were by the writer, and it is his opinion that there was no evidence of rickets or scurvy present.* Furthermore, subsequent cases, and the reports of cases from different localities and by different observers, confirm the conclusion that scurvy has no necessary connection with rickets.

Cases of rickets with associated scurvy have been cured of the scorbutic condition and still remained unimproved rickets.

Diagnosis.—If the mother assumes that the child has rheumatism of the legs, and the physician discovers spongy gums, that case will pretty surely prove to be scurvy.

Treatment.—Consist in correcting the æmia, fresh milk, orange juice, protection of tender parts of the limbs.

Prognosis.—Improvement follows in one week, recovery in three or four.

Vulvo-vaginitis.—In summing up a series of investigations upon the cause of vulvo-vaginitis in children Dr. Henry Herman, of New York, says:†

* Transactions American Pediatric Society, "Scorbutus in Infans," Northrup, etc.; also *N. Y. Medical Journal*, May 26, 1893; Northrup & Credé.

† *N. Y. Medical Record*, June 1, 1893.

"The classifications Roberts offered for acceptance are, as a rule, mixed types." He proceeds then to conclusions from his *own* observations.

"First, a catarrhal form, subdivided (a) into those due to acidities, foreign bodies and trauma; (b) infectious, but not gonorrhoeal.

"Second, (a) a gonorrhoeal type due to gonococcus (Neisser); (b) the mixed infection due to gonorrhea and possibly other diplococci."

It would seem that gonorrhoeal salivary-angitis to American practitioners is of more frequent occurrence than to the English. At least recent literature has had it rather more consideration.

The test for gonococcus of Neisser is so practicable for the general practitioner that it deserves mention. Heiman says in his conclusions:—"I believe the gonococcus of Neisser is never present in the normal anthera as far as my experiments have shown. The diplococci found in the normal anthera can be positively differentiated by the Gram stain. Gram stain is the only crucial staining test for the presence of the gonococcus (Neisser), and should therefore be employed in all cases." The details of this well-known staining are a matter of general text-book instruction.

Rickety Deformities (p. 401).—The transverse thoracic furrow, with the projection of the ribs forming the lower edge of the thorax, so very common in several cases of rickets, is often associated with more or less kyphosis of the dorsal-lumbar spine. Sometimes there is a marked depression on one side or the other at the costo-vertebral articulations of the three or four lower ribs. This deformity may or may not be due to rickets. All of these conditions can be very much improved by applying a light steel spinal brace to hold the spine erect and draw back the shoulders. Over this brace is applied a cover made of drill, which exerts pressure on the lower projecting ribs only, and freens abdominal respiration. Thoracic respiration is then developed by respiratory exercises. The result will repay the surgeon for the persistent work necessary, as the writer has seen in a number of cases.

Curvature of the neck of the femur, Coxa Vera (p. 407).—A number of cases of this deformity have been recorded here already by Curtis, Whitman and others, and it seems likely that when more attention is directed to the condition our experience will be similar to that of Hofmeister and other German surgeons, who have found that the deformity is not very uncommon. It is produced by the weight of the body and diminished resistance in the bone. It is observed in two-thirds of the cases during childhood, and in the remaining third at the age of puberty. The affection starts with pain in the hip and limping; at first in consequence of a long walk or great fatigue; later, after a moderate walk; ultimately no walk is possible. Flexion is especially impaired in bilateral cases. The disease runs its course with periods of remission and exacerbation. In two or three years the pain ceases, and there remains as a final result an actual shortening of the limb, the great trochanter being above Nelaton's line. There is diminished abduction and inward rotation. The limb rests in a position of outward rotation, and the patient can produce exaggerated rotation in this direction. The walk is in consequence characteristic, and when the patient wants to assume a kneeling position he is obliged to cross his legs. The exact point of this reservation is on the outer side of the neck and a little posteriorly, which explains the elevation of the trochanter and the outward

rotation of the limb. A large number of so-called stryptic cases of ankylosis are really this infection. The diagnosis is important with reference to the question of early cauterization, sometimes recommended in hip disease. Bone will soon stop the pain. Then continuous extension, massage, and exercise may benefit some cases. The neck of the bone should certainly be relieved from the weight of the body by means of a hip-splint or auxiliary crutches, during the progressive stage. No premises should be made of diminishing the amount of curvature of the bone fixed when treatment is commenced.

Schäfer has found this condition in rachitic children who have not begun to walk, and ascribes it to traction of the muscles attached to the trochanter.

Stahler (p. 401) favors supporting the kyphotic spine in severe cases of rickets during the progressive stage in order to secure bone growth in the normal planes. In this way not only can we readily, and without discomfort, correct the existent kyphosis, but also prevent or prevent the development of lateral curvature, since many cases of this curvature are dependent upon a rickety condition and develop very early in life.

The splint most commonly used in New York for knock-knee and bow-legs is shown in Fig. 191. The jointed apparatus is efficient, since leverage is applied whenever weight is borne. It also favors muscular development, and allows a more gradual gait. A pelvic band may be added to control the position of the feet if required. These braces are somewhat expensive, but at the New York Orthopedic Hospital this objection is met by allowing the patients to pay for them on the installment plan. The Knight brace (Fig. 192) for bow-legs, and the Thomas knock-knee brace, are also largely used (see Fig. 70). These deformities can be more quickly corrected if, in addition to the application of the splints, the limbs be bent by manual pressure towards their normal position several times each day.



FIG. 191.—New York Orthopedic Hospital Brace for Knock-knee and Bow-legs.



FIG. 192.—Knight's Bow-leg Brace.



FIG. 193.—Boston Children's Hospital Brace for Bow-legs.

The pressure should be as great as the child will bear without crying, and should be maintained a minute or two, then relaxed and reapplied several times. In the very slight grades of deformity these forcible intermittent pressure-exercises may be sufficient to cure without the use of braces.

In the Children's Hospital in Boston, the apparatus in common use for bow-legs (Fig. 141) is a light but rigid steel upright, joined at the middle, attached below to the soleplate of the shoe. It runs up the inside of the limb nearly to the origin of the adductor muscles and is then bent forward and upward and curved to fit two six-point and come up as far as the posterior part of the distal end of the ilium. Leather pads opposite the greatest convexity of the curve draw the limb over to the upright. For knock-knee a similar apparatus is used, but is applied on the outer side of the limb, and at the level of the trochanters the upright is bent backward and upward to lie against the upper part of the femur. By fastening the upper ends together the position of the feet can be controlled.

For extreme deformity powerful correcting apparatus have been devised by Shaffer (*American Journal of Orthopedics*, etc., vol. xiv., No. 11.)

Whether a case will require operative treatment depends more upon the flexibility of the bones and the laxity of the ligaments than upon the age of the child or the amount of deformity. Anterior curvatures of the tibia have seemed to the writer the most amenable to mechanical treatment, and generally require no operation for their correction (see also Traill and Lovett, "Orthopedic Surgery," p. 682).

In America, Macewen's operation (p. 420) for genu valgum is chiefly employed. MacCormac's modification, in which the chisel is used upon the outer side of the limb and a green-stick fracture produced on the inner side is also thought well of. In any case the practice is to wait until the active stage of the disease is past before operating. The saw is almost never used here. In general osteoclasis is not so much in favor as osteotomy. Russell's or Garton's osteoclasis are those most used.

The mechanical treatment of fractures and osteotomies as recommended by Barfield, Knoch, Albers, Kraus, Dellinger, etc., has not as yet received enough attention in this country to report upon its usefulness.

Lateral Curvature of the Spine. *Early Onset* (p. 421).—Is a study of two hundred and twenty-nine cases. Ketch (*New York Medical Record*, April 24, 1886) found (1) that this curvature is principally a disease of childhood, and may be either congenital or acquired; (2) that puberty, except as a complicating occurrence, which may by its attendant circumstances increase it or bring it into actual prominence, has no direct causative influence; (3) that lateral curvature should be looked for only in life, and as a factor in treatment the early inspection of children's spines becomes most important toward the prevention of the deformity.

Russell and Lovett also ("Orthopedic Surgery," p. 106) regard its appearance at an earlier age than is usually supposed.

Treatment (p. 424).—Shaffer relies largely in cases of early lateral curvature on an exercise partly active partly passive. Pressure is made by the operator's hand just under the greatest convexity, in a direction inward, forward, and upward, the opposite shoulder being elevated at the same time. The patient bends

over the hand exerting the pressure and untwists the spine as much as possible. The counter-pressure is exerted below by the weight of the pelvis and limbs, and above by the weight of the upper part of the thorax and head, increased, if necessary, by pressure from the operator's hand, which is being used to elevate the shoulder opposite the projecting ribs. In giving the exercise the patient swings obliquely forward and backward, and at every backward swing the pressure is applied along the body parallel the perpendicular. The patient is also encouraged to swing both arms long at unequal heights, so as to overcorrect the drooping shoulder. These exercises are given once, twice, or three times a day for four five to twenty minutes. *Boyc* (*New York Medical Journal*, November 27, 1888) advises the following movements, which are very similar to those of Bernard Roth ("Treatment of Lateral Curvature of the Spine," London, 1889) and are, with modifications, those most generally used in the United States. The various exercises are repeated three times each at the commencement and later on a greater number of times.

"The patient lies prone, the arms at right angles to the trunk, palms down, feet turned to the convex side, and the back as straight as possible. The patient raises the hands, draws the scapula well back, raises the hands from the floor and lifts the trunk, while the surgeon holds the feet down. The trunk should not be held during any of these exercises, but the patient should breathe naturally. If necessary to secure this, make them raise and hold while exercising.

With hands behind the head, the patient raises the elbows from the floor, and raises the trunk as before, the feet being held by the surgeon.

With the hands behind the head and the elbows raised, the body is moved toward the convex side, the patient trying to "push in" the bulging ribs and not to bend in the lumbar convexity. The feet are fixed on before.

With the arm on the side of the convexity under the body, the other arm over the head, the body fixed, the patient raises the trunk from the floor.

Sometimes the arm on the side of the convexity is put on the opposite buttock, while the patient raises the trunk. Sometimes the arm on the convex side is put on the lumbar, and in cases of marked kyphosis, with great drooping of the shoulders, both hands are put on the buttocks while the patient raises the trunk.

The patient now lies on the back, arms on the sides, palms up, and lifts first one foot in the air, while the surgeon makes resistance gradual to the patient's power; repeated, say, five times. The same is done with the other foot, and then with both. The feet are each separated and then brought together once more while the surgeon resists. Each leg then describes a circle, first from within out, then from without in.

If there is special weakness at the ankles, with a tendency to flat-foot, the patient flexes the foot and extends it against resistance, and turns the sole of the foot toward its neighbor, the surgeon resisting, and it is then flexibly turned again by the surgeon, the patient resisting.

The patient now lifts the arms from the sides, passing perpendicularly to the floor till they are stretched as far beyond the head as possible, and then, going at right angles to the trunk and parallel with the floor, returns them to the sides, palms up.

While the heels are held, the patient rises to the sitting position, hands at the sides; then she rises from the floor with the hands behind the head and the elbows at right angles to the trunk.

The patient now stands with the heels together, toes turned slightly out, hands behind the head, elbows at right angles to the trunk; then rises on tip-toe, bends the knees and hips, keeping the back as straight and erect as possible, and rises up once more. With the arms on the concave side, high above the head, the arm on the convex side at right angles to the body, she rises on tip-toe, bends the knees, arms, and makes as in to squat, then rises and stands. All this time care must be taken to push the body as straight as possible, and gradually educate the patient to hold it so without wiggling during these movements.

Let the patient practice walking in these positions, heel on the flat foot and spine, and also step high as if walking up-stairs. With the palm of the patient's hand on the convex side against the ribs, pushing them in, the hand on the concave side, the palm a slight weight up in the air, while the body swings so as to straighten out the curves.

Set behind the patient, fix her thighs with your knees, while she holds both arms above the head and leans toward the floor, keeping her knees stiff while you keep her ribs as straight as possible with your hands.

With the arm on the concave side across the top of the head, and the arm on the convex side around in front of the shoulders, the patient bends to the convex side through the ribs, and not through the waist.

The patient sitting with the back toward the surgeon, the latter pushes one hand against the most projecting part of the concave, and, with the other hand passed under the shoulder of the convex side, straightens out the curve as much as possible, the hand on the "bulge" acting as a fulcrum in straightening the curve.

The patient lies on a stool in front of the surgeon, who fixes the pelvis with his knees. The patient then rests the projecting shoulder in the front while the surgeon holds the elbows, which are at right angles to the trunk, the hands being behind the head, and makes resistance. In the same position the patient swings forward and back, swinging through the hips, keeping the back stiff, and not bending in the waist.

The patient pushes in the ribs on the convex side with the hand, and pushes up with the hand on the concave side, the same as when standing. The arm tips the arm on the convex side up at right angles with the body while holding a weight.

In cases of round shoulders, windmill motions of both arms and to-and-fro movements of the head against resistance are advisable.

The patient lies prone on the couch, all the body above the waist projecting from it, while the surgeon holds the heels. With the hands behind the head, the elbows thrown back, the body is bent toward the floor, then raised up; later on, resistance is made by the surgeon. The patient lies on the concave side and rises up laterally. The patient lies with the convexity on the edge of the couch, and hangs off as far and as long as possible.

One of the best exercises for correcting the curve is for the patient to place one heel in a collar attached to a cross-bar above the head, suggested from the veiling

by a compound pulley and rope. The patient now grasps the rope as high up as possible, and pulls up hard over head until the feet just touch the floor. While hanging thus she takes slow deep, full slow inspirations and expirations. While she is hanging thus the surgeon corrects the rotation by pushing the ribs with one hand while he steadies the pelvis with the other.

Another good thing is for the patient to have a belt passing around the pelvis, with a handle on each side. Holding these in the hands, she straightens the spine out, and the spinal column is then stretched and straightened much in the same way as by self-exercise.

The patient stands bent forward as if playing leap-frog, her hands on a chair, while the surgeon, with one hand under the shoulder on the convex side and one hand on the projecting ribs, corrects the rotation. It is advisable to steady the patient with one knee while doing this."

Tschachtler has lately (Annals Surg., Aug., 1895) advocated the system of exercises used by the German athlete Atilla. This consists of a long series of the most light dumb-bell exercises with poising of the body in various positions. These are followed by swinging and raising at arms' length along the head very heavy dumb-bells and bars. The object being to thoroughly tire out the weak muscles, on the ground that in this way only can they be fully and rapidly developed.

Richardson and other very forcible methods of reducing rotary lateral curvature have not found thus far much favor in this country.

Apparatus for Lateral Curvature.—The supports used in the United States for lateral curvature are employed to retain an improved position and to relieve pain and weakness. Muscular development is at the same time encouraged in every way, the idea being to lay aside the apparatus as soon as the muscles have been made strong enough to retain the improved position. Some cases now late in the disease cannot be improved in respect to disfigurement, and yet feel much more comfortable if properly supported. Others, again, from cardiac or pulmonary complications, cannot take the exercises required, and the ultimate results are better when mechanical treatment is carried out. In order that the appropriate exercises may be given all supports must be removable. Probably the plaster-of-Paris jacket applied with suspension is more generally used than any other method. Some mould the patient's figure with his hands as much as possible after the jacket is applied and before it hardens. He uses the jacket as an adjunct and only in those cases where the patient is not able to retain by voluntary effort so good a position of the body as can be obtained by partial self-suspension by means of a pulley and bandaging. Bradford uses, in cases which are markedly corrected and in growing patients where rigidity is not complete, permanent plaster-of-Paris jackets, exerting a correcting pressure upon the abnormally prominent ribs, while the jacket is still soft, from behind forward and from before backward, by means of a screw force extending from a circular steel ring which is placed around the patient's trunk temporarily while the jacket is being applied.

Stoick recommends a raw-hide jacket. Phelps uses an aluminum corset (Trans. Amer. Orthop. Assoc., 1895), or one of wood-shavings (Walpack Method, New England Medical Monthly, February, 1892), and Vance one of paper. Robinson ("Transactions Ninth International Congress," vol. II) has devised a wire corset.

designed to exert a continuous elastic pressure. Shaffer uses a light steel apparatus, adapted to exert pressure in the desired direction, at the same time allowing some extent posterior movements of the trunk. Exercises are systematically used in addition.

DISEASES OF THE BONES.

Ununited Fractures (p. 309).—Ridley, in case of delayed union in fractures of the leg (*New York Medical Journal*, January 31, 1891), following Thomas, advocates the use of the latter's copper splint, but is dissatisfied as to result of no motion at the ankle, and with a layer of leather leggings added.

The advantages claimed over plaster-of-Paris are better immobilization, and no constriction at the seat of fracture. The apparatus allows the patient to go about during treatment and permits the production of adhesion by drawing.

DISEASES OF THE JOINTS.

Omph (p. 431).—Nathrop has given some interesting records of satrophies bearing on this point (*New York Medical Journal*, February 21, 1891). He found that the primary seat of tubercular infection was in the bronchial lymph nodes in a great majority of cases. In 123 cases examined, 34 had too extensive lesions to determine which was primary; 20 had the oldest lesion in the respiratory tract; 42 had cheesy masses in bronchial lymph nodes only, more recent tubercles were found in lungs and elsewhere. In 9 all the tubercular process was confined to these nodes and the lungs. In 13 it was limited to the nodes alone.

Abscess in Joint Disease (p. 625).—The treatment of tubercular abscesses has always been a matter of debate. Townsend (*Trans. Amer. Orthop. Assoc.*, 1891) has found that nearly fifty per cent. of a large number of cases which he collected and analyzed were by repeated aspirations relieved and the abscess eventually disappeared. Some surgeons incise and drain them as soon as fluctuation is found, whether they have become infected or not.

In a paper on "Operative Interference in Abscess of Chronic Tubercular Disease of the Joints," read before the New York Academy of Medicine, in October, 1891, Shaffer said that he waited until there were severe general or local symptoms due to the abscess itself before he incised it. So long as we know of its existence by sight and touch only, we were justified in ignoring it. He found that many of these disappeared, and few, if any, gave rise to trouble, and that those which opened spontaneously as a rule did well. In the adult and adolescent, an invariably favorable prognosis could be given if the non-operative method be adopted together with efficient mechanical treatment, whereas the prognosis was not so certainly good if the abscess were opened upon. The efficiency of the mechanical treatment was, of course, very important. There are cases in which mixed infection occurs and in which there may be symptoms indicating a minor degree of septicæmia. Even here Shaffer advised waiting awhile before incising. If the joint is properly protected, the urgent symptoms will probably subside. If they persist, a free incision must be made. Ordinarily the abscess should be allowed to open spontane-

ready, then simple external dressings are applied and the parts kept clean with peroxide of hydrogen or bichloride of mercury. The ultimate recovery of the joint is better under the non-operative treatment than after incision of the abscess.

Dunn has endeavored to find a method of discovering whether these cold abscesses have become infected or not, and has published his work in a recent number of the *American Journal of the Medical Sciences*. His conclusions are:

1. Most cases of tuberculous of the bones and joints do not decrease the number of the red corpuscles in the blood.

2. They do, however, affect the percentage of hemoglobin, giving rise, in fact, to a mild degree of chlorosis.

3. The leucocyte count seems to have no special relation to the temperature.

4. High counts, especially in hip disease, point to the probability that there is or shortly will be abscess formation, but low counts do not preclude the presence of pus, especially in long-standing cases.

5. Where an abscess is found in the face of a low leucocytic count, the pus from it is sterile, that is, does not contain pyogenic organisms; it does often contain tubercle bacilli. The case is generally one of long-standing.

6. In the presence of an abscess a low leucocyte count indicates the absence and a high count the presence, of a secondary infection with pyogenic organisms.

7. Cases where at the primary operation the pus has proved sterile, generally show an increase in the leucocyte count, and especially in the differential count, where the wound becomes infected with the pyogenic organisms.

8. High total leucocyte counts do not always affect the differential count.

Dunn in these investigations used the Thomas-Zeiss apparatus. The red pipette was diluted 1-200 with "Tolson's solution," and the white is a separate pipette 1-200 with 3% acetic acid solution and a little methylene violet. The dry slides were hardened in benzene, and stained with Ehrlich's triple stain.

CASE I.—Boy six years old. Hip disease, one and a half years' duration. Developed an abscess about four months previously. Entered with large fluctuating tumor both in front and behind joint. Operation showed 3½ greenish puriform material. Head of bone nearly separated, and rim of acetabulum much roughened.

Blood count:

Erythrocytes	4,096,000
Hemoglobin	75
Leucocytes	4,793
Lymphocytes	835
Large mononuclear and transitional forms	126
Polynuclear neutrophils	516
Eosinophils	21

Pus proved sterile from pyogenic organisms.

CASE II.—Girl three years old. Hip disease, seven months' duration. Absent for two months. Large fluctuating swelling on anterior aspect of thigh over great trochanter. Operation gave 3½ pus, and showed a sinus leading into the joint, which was not much disintegrated.

Blood count:

Erythrocytes.....	5,344,000
Hæmoglobin.....	65
Leucocytes.....	47,364
Lymphocytes.....	825
Large mononuclear and transitional forms.....	57
Polynuclear neutrophils.....	815
Eosinophils.....	05

Pus showed the presence of *Staphylococcus pyogenes aureus* and *Staphylococcus pyogenes albus*.

Mechanical treatment. Shoulder (p. 145).—To apply extension at the shoulder Shaffer uses an auxiliary crutch, to which is attached an extension-bar running down the inner aspect of the arm, and terminating in a band which fastens the arm. Adhesive strips are applied and fastened to this band, and the extension-bar lengthened as required.

Townsend (Trans. Amer. Orthopedic Assoc., vol. vii) claims that the usual limitation of this disease under mechanical treatment is actually more or less complete, as a rule leaving the ability to raise the arm from the side to about one-third or one-fourth the normal amount. This loss of flexion is a serious matter in many cases, and only such work can be done in severe cases as requires but little force, and such as can be supplied by the forearm alone. When the patients cannot get the hand to the head to feed and dress themselves the condition is not so serious. Townsend claims that after partial or complete excision much more freedom of motion can be obtained in most cases. Rejecting the statistics of pre-operative life the operation does not appear to be dangerous. The joint is easy of approach, and in a large majority of instances the disease is located in the head of the humerus, and can thus be entirely removed. By partial operations and the subperiosteal method the growth of the limb should not be much affected. In regard to mechanical treatment Townsend says that in no case that he had treated was his method given a fair trial, but that from careful reading and the examination of some patients supposed to have been subjected to careful mechanical treatment he had been led to the belief stated above.

Mosses and Aclay (Revue de Chirurgie, 1922) found in the results of thirty-two excisions, all done on patients near adult life, that the starting point of the disease was in twenty-nine cases in the bone, in one distal, and in three it was clearly synovial. In twenty-three of these cases the disease originated in the humerus, in four in both the scapula and the humerus, and in one in the scapula.

Elbow (p. 616).—To immobilize the elbow Mayo uses a splint formed by wires that follow the upper and lower borders of the hand and forearm, the anterior and posterior borders of the arm, and then descend on the side of the body to the waist-line; a towel sleeve holds the hand and forearm, and another the arm. Thoracic and abdominal straps hold the splint firmly against the body. This controls the short limbs of children well.

Wrist-joint. Excision (p. 617).—Myer (Trans. Amer. Orthopedic Assoc., vol. vii) considers the results of isoholone injections excellent, and therefore thinks early operation distinctly contraindicated. Excision should only be resorted to in

old and neglected cases, and in these it is impossible to remove by the usual longitudinal incisions of Ollier and Lister the fatty, degenerated, softened, and cartilaginous except in place, leaving a large amount of the tuberculous bony tissue and a still larger amount of the tuberculous synovial tissue in the wound. The treated suppuration and tuberculous plaques necessitating repeated operations, and possibly amputation, may follow. In order to gain free access to the diseased focus, Myer, following the suggestion of Stadiguard, advocates a complete splitting of the hand from before backward, but he makes his longitudinal incision between the second and third metacarpal bones, then entering between trapezoid and scaphoid, and between scaphoid and semilunar bones, as the hand is more easily divided by this incision than by the one recommended by Stadiguard, which passes between the third and fourth metacarpal bones, and then opens up the joint between an scaphoid and ariform bone, and between ariform and cuneiform bones. Myer operated in March, 1894, by this method. He made the dorsal incision reach up to the radius, but found it unnecessary on the palmar side to extend the incision farther than the base of the thumb of the thumb. The annular

ligament was, therefore, not severed. By careful dissection from the dorsal side, and careful separation, he found it easy to avoid wounding the dorsal tendons and the large palmar tendinous band. The whole apparatus could now be widely opened, and it was extremely easy with scissors to extirpate the two halves of the corpus, and with a fine saw to remove the surfaces of the radius, ulna, and the metacarpal bones. The cavity was packed with iodoform gauze. The wound healed promptly and the result, eight weeks after the operation, was extremely gratifying. The patient can actively extend and flex the wrist and move the fingers, but there is still some looseness of the wrist-joint, though it is steadily getting firmer. Myer considers this operation far superior to Ollier's and Lister's longitudinal, or the old transverse incisions, as by these last methods we necessarily get adhesions of the tendons to the capsule.

Hip joint.—In the United States all surgeons agree that during the acute symptoms of hip-joint disease the limb must be immobilized as perfectly as possible. Traction is applied during this time to overcome the reflex muscular spasm almost as invariably. After the pain and deformity are overcome, the practice varies somewhat. Some favor only on immobilization alone, using a plaster-of-Paris spica, or a Thomas hip-trait, or similar device. The large majority, however, combine traction with immobilization, more or less complete, until all reflex muscular spasm has disappeared. After this the joint is still protected from pressure for months to avoid a relapse. In the United States, therefore, the long traction hip-splint (Davis-Taylor) (Fig. 320) is used almost exclusively until the convalescent stage. Then Sayre sometimes



FIG. 320.—The Davis-Taylor Long Traction Hip-splint.

uses his short traction splint, or, like Shaffer, Taylor, and Bradford, a periodical crutch-permitting motion at the knee and affording a modified protection from the transmission of percussion.

Where the child is large or very heavy the use of auxiliary crutches—in addition to the hip-splint, will be advantageous in some cases. As much traction is applied by the hip-splint as can be borne with comfort by the patient. Where slight traction causes pain, this is the indication of an abscess under the femoral sheath.

Knee-joint (p. 637).—Traction is successfully used also at the knee to reduce the deformity and relieve the pain. It must be applied in the direction of the deformity, and continued as long as there is any reflex muscular spasm. Mayo's extension knee-brace is, perhaps, the one best known. Where there is deformity New York surgeons employ traction for a longer time than is recommended in England (p. 631), before resorting to forcible manipulation, in many cases which will not yield in a few weeks will do so in a few months, and all traumas will thus be avoided. Many surgeons who apply traction at the hip-joint, however, are content to protect the knee-joint from motion and percussion.

Shaffer recommends a splint for cases of subluxation (p. 638) unless there is ankyrosis, which requires forward pressure on the head of the tibia, and longitudinal traction in the line of the deformity (*Archives of Clinical Surgery*, June, 1877).

Goldthwaite (Bost. M. & S. Jour., Sept. 7, 1881) describes a very admirable modification of Bradford's apparatus for correcting posterior subluxation of the head of the tibia in cases where there is no bony ankyrosis. Under anesthesia the adhesions are broken up carefully by one or more applications of the lever, and a protective splint worn afterwards until the disease is cured (see Fig. 109).

Amputation (p. 633) for tubercular disease of the knee-joint, without other lesions, is very rarely done here. Gibney has had but one case requiring it in the last five years at the Hospital for the Relief of the Ruptured and Crippled; at the New York Orthopedic Hospital this operation has not been advised or done in that time.

HIP DISEASE.

Muscular Spasm (p. 645).—Irreversible reflex muscular spasm is generally considered in America the most common symptom of Hip Disease. It appears first and disappears last, and is the safest guide as to the presence or absence of the disease.



FIG. 109.—Heath & Goldthwaite brace for correcting deformity at the knee.

To apply the brace: The head of the rod is forced forward as far as possible by the screw "b" working in the arch "a," which raises the cross bar "c" to which the posterior band "d" is attached by the metal levers "e." The contracture is relaxed by the straps "f" and "g." The leg is then gradually straightened by the lever arm "h."

The writer during his observations of hip-joint disease under the tubercular treatment at St. Luke's Hospital, made daily careful examinations, and came to the conclusion that the reflex muscular spasm was the first symptom affected by the injurious. In the cases with more marked reaction the symptoms, although lasting but a few days, exactly resembled the usual exacerbations of the disease, with increase of reflex spasm, less motion, or even appearance of deformity, increase of pain and sensitiveness, and recurrence of night cries. In less marked reactions several times the reflex muscular spasm became more silent, though there was no rise of temperature, nor appreciable increase of joint-insensitiveness or decrease in motion. One case he had examined repeatedly six weeks after all pain, deformity, and limp had disappeared, and the reflex spasm was always detected.

Deformity (p. 657).—Exacerbations sometimes follow rapid reduction of the deformity under anæsthesia. When traction is used for this purpose it must be applied in the line of deformity, whatever the position of the limb may be.

Philps ("Transactions, New York State Medical Society," February, 1889) strongly recommends that traction be made in the line of the axis of the neck of the femur, not in the axis of the shaft.

Philps (p. 645) explains the deformities of the different stages of hip-joint disease as follows: The first stage is produced by voluntary effort on the part of the patient, aided by spasm of the muscles, in order to relieve the tension of the Y-ligament and capsule of the joint; hence abduction, outward rotation, and flexion. Muscular spasm and a voluntary effort exaggerate the deformity of the first, producing that of the second stage. When flexion takes place beyond thirty degrees, and often with less flexion, the limb rapidly assumes the position of the third stage (with its occasional exceptions), adduction, inward rotation, and flexion, for the following reasons: when the limb is thus flexed the glutei muscles and the tensor vaginæ femoris become inward rotators. The glutei cease to be abductors, and the external rotators are no longer rotators but abductors, with the exception of the quadratus femoris and obturator externus. The abductors, now being no longer antagonized by the great glutei muscles, cease the abductions.

The middle deformities be accounted for by destruction of bone changing or destroying leverage, narrowing of joint, dislocation, protraction of vertebrae, and locking of the head of the femur in the pelvis; possibly by the location of the lesion, adhesions, and irritation of special nerve-plates supplying the joint. The fluid tension hypothesis he thought erroneous, because many cases were extended by effusion, and every case of all the deformities seen in hip-joint disease were extra-capsular.

Results (p. 660).—Sayre (*New York Medical Journal*, April 30, 1862) shows that in 407 cases treated by him without excision, the ultimate result was:

Cure, motion perfect	34
" " good	147
" " limited	83
" ankylosis	5
Unknown	78

Under treatment, 14; abandoned, 3; discharged, 2. Total deaths, 9.

As the Thomas hip-splint (p. 510) does not afford traction it is not commonly used in the United States.

Excision of the Hip (p. 657).—In general there is a strong conservative feeling in present among American orthopedic surgeons as to the question of hip-joint excision. It is considered a last resort, to be applied only in exceptional cases where conservative treatment cannot be carried out, or as a means of saving life. Bradford and Lovett express the general feeling when they say, "It must be borne in mind that the ultimate results after early excision are much more favorable than after late excision. Where a late excision is done the surgeons will always regret that the operation had not been done before. The results of careful conservative treatment, if carried out for a long time, are superior to those after excision in a majority of cases, and where conservative treatment is practicable it should be preferred. In large hospitals or among the poor and unintelligent class conservative treatment is sometimes impracticable, and in such cases excision is resorted to earlier than would otherwise be justifiable, and the results gained are more satisfactory than when the operation is deferred."

SPINAL DISEASE.

Symptoms (p. 663).—Myers has seen in several cases of high cervical disease severe attacks of dyspnea and heart-failure, probably due to pressure on the cord, even if these ending fatally.

Treatment (p. 671).—Russell is strongly advocated by Stoltz (*Medical Progress*, February 2, 1911), who straps his patient to a canvas-covered iron frame and applies head traction when the disease is in the cervical and upper dorsal regions (see also Bradford and Lovett, "Orthopedic Surgery," p. 54, and Schoppe, *Medical Record*, September 2, 1893).

Taylor's symmetrical brace (Fig. 126) is also largely used in America (p. 671) for disease in all regions. When the disease is above the seventh dorsal vertebra a thin-top with occipital uprights is attached to the brace by means of a ball-and-socket joint, placed as near the occipital-attaching point as possible, and the head can then be held in any position desired.

Taylor (p. 671) (*Medical News*, No. 2, 1911, p. 317) has devised a safe, efficient, and easy method of applying a plaster-of-Paris jacket. The patient sits upon a bicycle saddle with feet resting on and fastened to rigid stirrups. The hands grasp handles above and a little behind the head, so hyperextending the spine. Head suspension can also be added if necessary. In this way, without fatigue, without motion, and with rapidity a jacket can be applied to either a child or a heavy adult, and the support can be carried higher up in front than is usually done by the other methods.

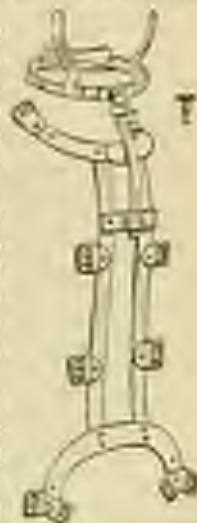


FIG. 126.—Taylor's Spinal Brace with Chin strap.

Lloyd (p. 676) (*Annals of Surgery*, October, 1902) has tabulated all published

cases of lumbago may be Tait's disease up to September, 1892, as well as several are previously reported. He concludes that the operation is definitely indicated in a certain limited class of cases.

Gilroy (p. 674) (*Journal of Mental and Nervous Diseases*, April, 1893), Taylor and Everett (New York *Medical Record*, June 19, 1893), Myers ("Transactions American Orthopedic Association," 1892), and Huddleston (*American Journal of Medical Science*, August, 1894) have presented statistics on a large number of these cases, showing the frequency of recovery from the paralysis without operation.

CLUB-FOOT.

Shaffer (p. 616) (New York *Medical Record*, May 25, 1893) described a condition of malated fascia on the ankle and a contracted state of the plantar tissues which he called non-deforming club-foot. The symptoms were awkward gait associated with painful calluses at various parts of the foot; or in some severe cases actual disability, pain in various parts of the foot, ankle, and leg, and even referred to the lumbar region; also tender and inflamed articular surfaces, especially at the junction of the first metatarsal bone with its phalanx.

Wilson (p. 663) ("Transactions of the American Orthopedic Association, 1892") advocates "the complete reduction of the deformity by the end of the first month of life, by simpler means if possible, by traction otherwise. The muscular power of the foot should be developed as much as possible afterward." Most surgeons would be willing to wait longer before resorting to operation.

It is not just to say that the surgeon meets a large class of cases which have been neglected for two or three years or more. These cases can be corrected by the simpler forms of splints, yet can be saved from operative treatment by the use of suitable stretching splints applied by a surgeon who knows how to use them.

The importance of maintaining the corrected position cannot be overestimated. Many of these deformities will surely and slowly recur, whether they have been cured by operation or without it, unless exercises, massage, and attention to the manner of walking are kept up for a year or so.

Phelps (p. 667) recommends the following order of operation, that one may follow the other as case is required: 1, strong manipulation; 2, subcutaneous tenotomy; 3, open incision; 4, linear osteotomy of the neck of the astragalus; 5, V-shaped piece removed from body of os calcis; 6, removal of callos and scaphoid; 7, Krugoff's apparatus. Exceptionally the order may be changed, so that after 4, revision of the astragalus may be performed.

Truiford ("Transactions of the American Orthopedic Association, 1892") found that "when the foot could not be brought straight after section of all the soft parts on the inner side of the foot, the resistance was generally located in the neck of the os calcis, and he advocated in these cases the excision of a wedge from this bone just posterior to the line of cartilage." He said: "In a normal foot a line drawn through the middle of the sole is a straight one, but in case of club-foot after the removal of the astragalus the median line is bent at the medio-tarsal articulation, formed an angle with the median line posterior to the articulation. This was due to the obliquity of the anterior face of the os calcis. See also Phelps's article on this subject (*Continuity Medical Magazine*, March, 1893).

Parish (p. 637) (*Medical Journal*, October 2, 1894) describes a method he has devised of uniting live tendons to those paralyzed, and in regaining foot function. He has united the healthy extensor pollicis tendon to the paralyzed fibular tendon to remedy a case of valgus.

Whitman (p. 696) (*New York Medical Journal*, November 9 and 16, 1895) has devised an arched steel sole for the treatment of flat-foot which acts as a lever to throw the inner edge of the foot up in walking and yet is so short that it does not restrict normal muscular action. If the foot can be replaced in proper position, if its movements are free and not limited by muscular spasm or inflammatory adhesions the sole can be applied at once, and with a proper shoe, an avoidance of faulty positions, and exercises for strengthening the weakened muscles the patient will be at once relieved.



FIG. 117.—Whitman's Flat-foot Support.

A. Astragalus-calcaneal point.
C. Ball of great toe.

B. Calcaneus-extend point.
D. Middle of heel.

If, however, the reduction by manipulation is impossible, the foot should be forcibly moved, under anesthesia, in all directions to break up adhesions, and then forced into a position of extreme adduction or equino-varus and retained there in a well-padded plaster bandage. Although great force is sometimes used, the after symptoms are usually slight, and the patient, if he desires, may walk about on the plaster bandage the following day. In from one to three weeks the bandages are removed and active treatment begins. The foot is now, though in good position, stiff, and all its movements are resisted and painful. It is, therefore, immersed in hot water, massaged, and slowly twisted into a position of adduction. Voluntary exercises are then executed for twenty minutes. These are repeated several times a day and the ergonovine daily forces the foot into the hyper-corrected position. The sole is made of thin steel milled while hot on an iron cast of the foot in its corrected position, and is then tempered so that it is unyielding under the weight of the body. Fig. 117 shows the form and application of these supports. Whitman calls attention particularly to the following points:

1. That there should be an accurate adjustment of the support to the cast of the corrected foot: (it is never applied to a stiff and deformed foot).

2. Lateral support is afforded as well as support from beneath, and thus is prevented the dislocation of the astragalus, (the abductor and valgus, the important elements of so-called flat-foot).

3. Leverage. The weak foot, properly balanced in a Wankenschuh shoe, and used properly, will press the outer arm against the sole, and thus tighten the inner ligament of the hump against the osseous-scapoid junction, where the preliminary bulging, the first sign of flat-foot, appears.

4. Non-interference with the functions of the foot. The component parts being held in proper relation to one another, the foot may again become strong by proper exercise, the proper walk, and proper attitude, and the brace may then be discarded.

Shaffer has found that in very many cases a shortening of the tendo Achillis provides the appearance of flat-foot. Flexion being generated at the ankle-joint arises at the medio-tarsal joint. He therefore advocates restoring to this tendon its normal length, as a necessary part of the treatment.

A very early sign of encroaching flat-foot is a rotation of the whole foot on its antero-posterior axis, therefore lateral support to the astragalus is important. As, after the bones have been restored to the normal position, a cure of the deformity must be maintained by increased muscular power, and as direct pressure weakens the muscle pressed upon, all steel soles and springs are theoretically objectionable.

The treatment adopted at the Orthopaedic Hospital to meet these indications is correction of the shortening of the tendo Achillis by forcible intermittent stretching, or tenotomy if necessary; correction of the rotation of the whole foot on the antero-posterior axis by manual or mechanical force; correction of the abduction of the toes in the same way, and maintenance of the corrected position by the use of steel ankle supports, riveted to the shoes, allowing free flexion and extension at the ankle-joint and so encouraging muscular development, yet affording firm lateral support to the tarsus and also holding the inner side of the foot a little higher than the outer side, which, therefore, is made to carry most of the weight in walking. (See Fig. 198.)

Torticollis (p. 691).—The Taylor spinal-antistick brace, with its chin-piece and upright supports, is well suited to these cases. It can be readily adjusted to any position of the head, and as easily re-adjusted to an improved position.

Kerr (*Annals Surgery*, October, 1891). Gardner (*Australian Medical Journal*, February, 1895). Powers (*New York Medical Journal*, 1892, p. 251), and others have removed the posterior branches of the upper cervical nerves with success after resection of the spinal accessory had failed.

Goss Resectum (p. 691).—Meyer is examining a considerable number of



FIG. 198.—Shaffer's Flat-foot Support.

1. Astragalo-scapoid joint. 2. Inner side of sole shoe raised higher than outer side, 3.

cases of genu recurvatum, found that the patella generally develop later on, though they may not be found at birth.

Arrest of Development (597).—Haus and Delner (*Arch. f. Anat. u. Physiol. Microsc.*, 1893) have found that in the majority of cases the lower limbs are of unequal length, that asymmetry is the rule and not the exception.

Club-hand (p. 597).—H. H. Sayre (*New York Medical Journal*, November 4, 1891) operated upon an aggravated case in which the radius and thumb were absent, as well as the first metacarpal bone and a certain number of the carpal bones. The marked curve in the ulna was first corrected by osteotomy. After union a straight line was secured, and after several weeks of stretching the contracted tissues had failed, the styloid process of the ulna was cut off, the os magnum and scaphoid removed, and the end of the ulna put into the gap in the carpus thus formed. The hand is now approximately in line with the forearm. There is free motion at the wrist, and the ability to grasp objects is greater than it was before the operation, though extension of the hand is poor.

Congenital Dislocation of the Hip (p. 201).—Gibney (*Annals Surgery*, December, 1894) says that the results he has obtained in his cases of congenital dislocation of the hip from Hoffa's operation have been far from satisfactory. He reports on six cases. He attributed his ill success to some fault of technique, since sepsis followed the operation in the majority of cases. The ages also of his patients was too far advanced in most of the cases.

Balford (*Annals Surgery*, xv., No. 2, p. 109) found that contraction of the anterior fibres of the capsule may sometimes prevent reduction.

Paci (*Arch. di Orthop. e. Str. is.*, No. 3, and *Ann. sc. No. 1*) reports on fifteen cases treated by his method, and the results are almost perfect a year or more after operation. His method is to firmly manipulate the limb, as if to reduce a traumatic dislocation—that is, the limb is first forcibly flexed as far as possible, then abducted, then rotated outward, then extended. Afterwards the thigh is held completely extended and immobilized, and traction applied. If the shortening is not completely overcome at the first operation, a subsequent one will probably accomplish the reduction. In about two months the plaster-of-Paris splint is removed and an extension apparatus applied. Four months after the operation the patient is allowed to get up and walk with crutches. At night the extension is trampled. The limb is massaged twice daily, and once a day receives electrical treatment.

Schäfer's recently recorded cases of this condition by conservative treatment seem to indicate that a persistent attempt should be made to cure without resorting to the open operations of Hoffa and Lorenz, if this is practicable. The results from operation should improve with improved technique and more careful after-treatment. Myers (*Annals Surgery*, December, 1894) found the mortality in one hundred and seventy-three recorded cases three and three-tenths per cent.

MILK.

A superstitious belief in the superior virtues of the milk of "one cow" is still common among the public, and it is often looked upon as a most important matter to secure this. As a matter of fact, a good average milk is more likely to be obtained from mixing the milk of a number of cows than in taking it from one, for it is well known that the first portions of milk obtained from the udder is poor in fat, while the last portions are rich, the amount varying from two to eight per cent. If the first part of the milk taken is reserved for the infant, it is tolerably certain to get a poor milk. Whenever a cow is specially reserved to supply milk for an infant, care should be taken to see that it is not an old one, and the last portions of milk should be taken for the child.

What is of far more importance than the question of "one cow" is the question as to how the cows are fed, and the care taken to prevent the contamination of the milk with organic matters. In the vicinity of our large towns it is no uncommon thing to see cows out at pasture in fields watered by brooks contaminated with sewage, of which they freely drink; moreover, they are extremely likely to lie down in the sewage water, and their udders, and consequently the milkers' hands, become befouled with sewage. In the winter time the cows are frequently fed largely on turnips and beets, instead of hay, mangel, or other dry fodder; possibly also their sheds are improperly cleaned out and only sparingly supplied with straw, so that the animals lie in filth, and their udders may be most cruelly soiled with dried excrement. It is no uncommon thing to find a greenish-looking sediment in milk from vacuum-tube dairies, due to contamination of fecal matters. The storage of milk is an exceedingly important matter, for milk readily absorbs gases, and is readily contaminated when kept in cellars or kitchens pervaded with sewer-gas or the emanations of decomposing animal substances. The temperature at which it is kept is also important, as it far more quickly turns sour and decomposes when kept in a warm place than in a cool place. This is recognized by many milk purveyors, who at once take measures to cool the milk directly it is received from the cow. According to Sahlsted fresh milk turns sour and curdles at the following temperatures and times:

- At 32° C. (90° F.) in 19 hours.
- At 25° C. (77° F.) in 24 hours.
- At 17½° C. (63.5° F.) in 65 hours.
- At 10° C. (40° F.) in 200 hours.
- At 6° C. (43° F.) in 3 weeks.

"Modified Milk."—Feeding of infants requiring a substitute for breast milk. American practice in the vicinity of milk laboratories has satisfied itself that "modified milk" is the most successful substitute feeding. In rounded statement, the composition of cow's milk may be set down as:

- Fat, 4 c.
- Sugar, 4 c.
- Albuminoids, 4 c.

High average breast milk may be set down as:

Fats, 4 g.
Sugar, 7 g.
Albuminoids, 2 g.

A low average may be set down as:

Fats, 3 g.
Sugar, 6 g.
Albuminoids, 1 g.

With these three sets of figures in mind in a majority of cases the practitioner may "modify" the proportions of fats, sugar, and albuminoids to the needs of the child, changing the proportions according to the indications ascertained from observing the nature of the passages and the general condition of the child. His orders for varied proportions be written in a prescription.

For a veryborn, upon the third day, the foregoing proportions may be temporarily lower in percentages.

Fats, 2 g.
Sugar, 5 or 6 g.
Albuminoids, 0.75 g.

Faithfully with these figures in mind it is not impracticable with the aid of the Babcock cream-tester and the sugar solution to prepare approximately a modified milk in a home-made laboratory. Such a laboratory is in use in two of the institutions for the care of young infants in New York.

It is the earnest hope of the profession of America that the feeding of infants may be kept within the domain of physicians and without necessary reliance upon the made-up foods of commercial firms. Cow's milk when modified to the proportions of fats, sugar, and albuminoids found in breast milk offers at present the most available and practicable infant substitute feeding. For exactness in modification a well-equipped laboratory, such as exist in Boston and New York, is requisite.

Professor Knapp, of Harvard University, has taught the profession to think in percentages, and has brought to practical completeness, by the aid of the Walker-Carlson Laboratory, prescription writing and exact modifying of milk.

The Pasteurization of Milk.—Pasteurization consists of two essential operations of equal importance. (1) Sterilization at $75^{\circ}\text{C.} = 165^{\circ}\text{F.}$, followed by (2) rapid cooling to about $10^{\circ}\text{C.} = 50^{\circ}\text{F.}$ The adoption of pasteurization has been due to our knowledge that such a procedure will destroy the pathogenic germs most found in milk; those of typhoid fever, diphtheria, cholera, and tuberculosis, as well as the *Staphylococcus pyogenes aureus*, the *Streptococcus pyogenes*, the *Coli communis* and the *Pseudomonas*. It also destroys most of the non-pathogenic bacteria. On the other hand pasteurization does not produce those chemical changes in milk which are produced by sterilization at $100^{\circ}\text{C.} = 212^{\circ}\text{F.}$, and which render the milk less digestible and less nourishing.

A milk pasteurizer known as Dr. Fricman's apparatus has recently been placed before the profession. This apparatus is simple and inexpensive and produces in the milk a fairly definite temperature of $35^{\circ}\text{C.} = 95^{\circ}\text{F.}$, without the use

of a thermometer, and is provided with a contrivance for rapid cooling. The apparatus consists of two parts: (199) a pail, and (200) a receptacle for the bottles of milk. The pail is an ordinary pail with a cover. Encircling the pail is a groove to indicate the level to which it is to be filled with water. The receptacle for the bottles of milk consists of a group of cylinders, each cylinder large enough to hold one bottle.

In using the apparatus, the pail is filled to the level of the groove with water and placed on the stove, the receptacle for the bottles of milk having been taken out. The bottles are filled with milk, stoppered, and placed in the cylinders of the receptacle. The space surrounding the body of the bottles in the cylinders is filled with cold water. When the water in the pail boils vigorously, the pail is taken from the stove and the receptacle containing the bottles of milk is placed in the pail (Fig. 199). The pail is then covered and allowed to stand on a table or the floor for half an hour. During this time an equalization of temperature takes place between the hot water and cold milk. During the first ten minutes the temperature of the milk rises to about 75° C. = 165° F., and remains there during the following twenty minutes. At the end of half an hour the cover



FIG. 199, 200.—Dr. Frothingham's Pasteurizing Apparatus.

of the pail is removed, the receptacle is elevated (Fig. 200) and the pail is placed in a sink under a faucet, from which cold water is allowed to run into the pail, thus replacing the hot water and cooling the milk. In twenty minutes the milk reaches about the temperature of the surrounding water and should be put in a refrigerator until used.

Pasteurized milk should be used only during the twenty-four hours following pasteurization.

HARLEY WATER.

Place a tablespoonful of brown pearl barley in an enamelled tin-pan, add a pint of water, and boil for a few minutes, stirring all the time so as thoroughly to crush the grain. Pour the water off the barley, replace by a pint and a half of clean water, and simmer gently for an hour, and strain. Another and better method is

to two barley meal prepared from the whole grain, inasmuch as the greater part of the gluten is found in the cells lining the husk (jacket). The grain should be well washed and ground in a coffee-mill kept for the purpose. The barley water used during the early months of infancy should be a thin mangelweiss fluid; in the later months it should be thicker, or barley jelly may be used to thicken the milk.

OATMEAL WATER.

A table-spoonful of coarsely ground oatmeal should be placed in a pint of water; simmer gently for an hour; replace the water evaporated.

ARROWROOT WATER.

Take two tea-spoonfuls of best arrowroot and a pint of water; simmer for five minutes, stirring constantly.

WHEY.

Warm a pint of milk or blood-heat; add a tea-spoonful of 'artificial rennet'; in a few minutes the curd will have separated from the whey; break up the curd with a fork and allow it to stand till the curd has unfolded; decant and boil the whey. Whey thus prepared may be given to a newly-born infant, cream or milk being added according to its powers of digestion. Whey with some added brandy is useful as a substitute for 'white wine whey,' and generally agrees better.

VEAL TEA.

Take one pound of veal free from fat and bone, cut into small pieces the size of dice, place in a covered jar with a pint and a half of water or barley water, cold; place in an oven not too hot, and bake for three or four hours—or it may be left in the oven all night; strain and remove fat.

SCRAPED MEAT.

Take a thick rumpsteak of the best quality; scrape it with a knife until reduced to shreds. A sandwich can be made by placing a small portion between very thin slices of bread and butter. Some children will take the meat pulp out of a few spoon or mixed with gravy or beef-tea. Scraped meat can also be prepared from rumpsteak which has been fried for a few minutes on a quick fire, the burnt outside being cut off before being scraped.

RAW MEAT JUICE.

Finely slice a pound of the best rumpsteak freed from fat. Place in an earthen vessel with sufficient cold water to well cover it, add some lump sugar, and let it stand for four hours. Strain through muslin. It can be given with port wine if thought desirable.

LINSEED MEAL POULTICE.

Warm a basin, pour in *boiling* water; sprinkle in the meal, stirring vigorously, till it becomes of the consistency of thick porridge; spread on new or old linen, turning in the edges all round; before applying put it against one's cheek to feel that it is not too hot. Keep in position with a broad flannel roller, secured with safety-pins. Remove every four hours or often. The poultice should not exceed half an inch in thickness. Caution is necessary in poulticing the chests of *infants*, in order not to overheat the chest and tire out the respiratory muscles.

MUSTARD POULTICES.

These may be made in a similar way to the above, the mustard being mixed with warm water, and stirred well into the flannel poultice. One part of mustard or three or four of linseed meal may be used for infants and young children, kept on for four hours, and repeated according to the amount of redness produced.

BRAN POULTICES.

Bran poultices are preferable to linseed poultices when the weight of the latter is an objection, as in *oedema*. A flannel bag is filled with bran, *boiling* water is then poured over it till it is thoroughly saturated; it is then wrung dry in a towel, placed against one's cheek to test the temperature, and applied.

HOT FOMENTATIONS.

Flannel or sponge-pile may be used, being wrung out of *boiling* water in a towel, sprinkled with lavender or turpentine according to the effect desired, and applied. The fomentations should be retained in position by means of a broad bandage.

ANTIPYRETIC METHODS.

Sponging.—The simplest means of reducing temperature when the fever is moderate in degree is by sponging. The child should be stripped and lie upon a blanket or sheet with a waterproof beneath; a large sponge should be used, and the face, trunk, and extremities sponged for ten or ten minutes. The water used should be cold, but with nervous patients it is well to begin with tepid water. If the child is fidgety it may have a hot bottle to its feet during the sponging. Cold sponging is a useful and safe means of reducing temperature in all febrile conditions, but its action is only temporary.

Packs.—The efficacy of a continuous pack in reducing temperature depends upon its action on the skin in producing sweating, the cooling effect of the application of the wetted sheet being temporary only, unless frequently reapplied. Packs are most useful in conjunction with *calomel* drugs, as *ammonia* and *quinine*. To apply a cold pack a sheet should be wrung out of cold water and applied to the patient from the neck to the feet; a blanket is then wrapped around the sheet. If

should be supplied in a quart or as low if the temperature appears high, but frequently the patient goes to sleep in the pack, and it may be wise to leave him undisturbed, for an hour at least. Cold packs are often of great service in scarlet fever, measles, and other febrile conditions. In pneumonia packs are often useful, the wet sheet being applied only round the chest.

Baths.—The cold or graduated bath is the most rapid means of reducing a high temperature, and has the advantage of being readily applied. The child may be placed in a bath of 100° F, and the temperature of the bath reduced by the gradual addition of cold water. The cold water may be poured over the patient's head if the temperature is high. Cold baths may be used in enteric, pneumonia, measles, induced in a high temperature from any cause excepting scarlet fever or diphtheria. In severe attacks of these diseases the cold bath is apt to depress too much, the patient becoming cold and collapsed.

Enema.—Enemas of cold water have been successfully used in reducing temperature, but can only be of limited application.

Ice-bags.—Ice applied to the head or chest in a rubber bag, or flannel wrung out of ice and water, forms an efficient means of reducing temperature.

Acetate.—Given in the form of rectum, is useful as an antipyretic in conjunction with packs. It is necessarily of limited application in account of the depression it produces if pushed. A quart or one minim may be given every hour in pneumonia, the effect being carefully watched.

Quinine.—Quinine may be given to reduce temperature in doses of two to ten grains of the sulphate in sugar-powder, milk, or *china*; it is useful for this purpose in conjunction with packs in malaria, scarlet fever, pneumonia, and measles. If given by the rectum, the neutral bisulphate should be used, or the sulphate should be dissolved with the least possible excess of acid. It is well to bear in mind that it is useless to expect absorption from a rectum lined with feces, and a douche of glycerine must be administered in order to rid the bowels before injecting the quinine. The quantity given by rectum must be double that given by mouth.

The subcutaneous injection of quinine is not often resorted to in infants, inasmuch as a neutral solution is not often at hand when wanted. In a high temperature due to malaria it would be of service.

Antifebrin.—This drug is much used at the present time in reducing high temperatures. It may be given in the form of powder; or in wine, as it is insoluble in water. It is better to begin with a small dose and to repeat every three or four hours if necessary. One-grain doses may be given under two years of age, two grains from two to four years of age, three to four grains for older children, and repeated if necessary every four hours. An overdose is apt to produce cyanosis, weak pulse, and profuse sweating. This drug is useful in acute pneumonia, measles, typhoid, and scarlet fever. The continuous use of it should be avoided if there are any symptoms of cardiac failure; toxic symptoms, especially jaundice and albuminuria, may arise.

Antipyrine.—This drug is used in a similar way to antifebrin: the dose given must be twice as large to produce the same effect.

Phenacetin is another drug of the same series, and may be given in doses of the

same size as antifebrin. This is much preferred in the United States to other drugs of its class, as being safe and equally effective.

HOT PACKS.

Hot packing is most useful in nephritis, especially when the kidneys are choked. A blanket is wrung out of hot water as dry as possible and quickly applied, care being taken that it is not too hot; it may be removed in half an hour.

HOT AIR OR VAPOUR BATHS.

These are useful under similar circumstances to the hot pack; they are best applied by means of a special apparatus, Allen's being the best. A hot vapour bath can be improvised for a child with a 'bambino bottle,' or even an ordinary bottle, and spirit or paraffin lamp, a chair being used as a 'caddy.' There is, however, some risk of accident.

MUSTARD BATH.

An ounce of mustard to a gallon of water (160° F.) is the right proportion. The mustard should be made into a paste on a basin, and gradually stirred into the water of the bath. Useful in diarrhoea, pneumonia, or collapse from any cause; more especially in infants and young children.

NARCOTICS.

Opiates.—Infants are sensitive to the action of opium, and this drug requires to be administered with great caution and its effect carefully watched. At the same time there cannot be a doubt as to its value in many instances, particularly in relieving pain and quieting the action of the bowels. In prescribing it to infants, not only the question of age, but also the size of the child, and the complaint from which it is suffering, and the degree of exhaustion present, must be borne in mind. It is obvious that the dose of opium suitable for a strong, well-nourished infant of six months of age, suffering from colic, might be deadly if given to an infant of eighteen months in the last stages of gastrointestinal atrophy. Infants in the last stages of diarrhoea, anæmia, and pneumonia are extremely sensitive to opium, and caution should be observed in giving it to them. Moreover, such infants pass sometimes into a comatose state before death, not unlike the condition produced by opium poisoning, and under these circumstances the immediate cause of death might be attributed to opium. As a general rule, and presuming the infant to be a well-nourished one, $\frac{1}{4}$ grain of Dover's powder may be given to an infant of six months and repeated in four hours if necessary. Larger doses may be given with safety if the infant can be watched, and indeed, if the infant is suffering from acute colic or intussusception, twice or even four times the dose named may be given. In one case coming under our observation, $\frac{1}{2}$ grain of acetate of morphia was given to a strong infant four months of age suffering from acute abdominal pain; the infant became drowsy, the pupils were semi-contracted, it remained in a semi-comatose state with sighing respiration for two or three hours, when it woke up

perfectly well. It was evident, however, that the Hall of safety had been passed. Three grains of opium, less or. (8*gr.*) were given to an infant of six months, who was weak wasted and suffering from diarrhoea, at intervals of four hours, three doses being given in all. The second dose made it doctory; it died a few hours after the third dose, with all the symptoms of opium poisoning. It had taken in all nearly $\frac{1}{2}$ grain of opium. One grain of Dover's powder, or a minim ($\frac{1}{60}$ grain) of *hy. morphia*, is an average dose for an infant a year old, and may be repeated in two or four hours if necessary. Two or three grains of Dover's powder, or two or three minims of *hy. morphia*, may be given to children between two and four years of age. Children over six years of age are much less sensitive to opium than younger children, and $\frac{1}{4}$ to $\frac{1}{2}$ grain of opium may be given if necessary to relieve pain in pneumonia or other disease. It must be borne in mind that asthenics may be met with, and infants may be found exceedingly sensitive to opium, or, on the other hand, very tolerant.

Subcutaneous injections of morphia are best avoided in infants under a year, and are not often required for young children; $\frac{1}{16}$ grain would be a full dose for an infant of a year.

Codaine is of some value in relieving pain in children, especially in connection with the alimentary system. It may be given in syrup of orange. It may be given in doses of $\frac{1}{2}$ – $\frac{1}{4}$ grain to infants and young children, and $\frac{1}{2}$ – $\frac{3}{4}$ grain to older children. It is useful in colic, diarrhoea with tenesmus, and irritative cough—in the latter perhaps not so good as morphia.

Chloral hydrate.—Chloral is soluble in water, and may be given 2 or 25 grains to the drachm of camomile water, sweetened with syrup of orange. Infants and children tolerate chloral well; its principal use, combined with bromide is in convulsions and to procure sleep. It is of but little use in relieving pain. 2½–5 grains may be given to children from a year to two years old. 5–10 grains may be given to older children. Very much larger doses have been given to procure anaesthesia (bushnet).

Bromide of potassium.—2–21 grains to the drachm of water sweetened with syrup of orange is lemon, and spirit of chloroform. The liquid extract of liquorice takes the taste fairly well. 3–5 grains may be given to children from a few weeks to two years of age, and repeated every two hours if necessary. 20–60 grains a day may be given to older children who are suffering from cerebral excitement or fits. There is little risk in an overdose; children well under the influence of bromide are lethargic, speak with a slow drawling tone, and suffer from fits.

Antipyrine acts as a sedative in small doses in infants and young children; 1–1 grain may be given to infants suffering from acute or painful dentition.

Belladonna and **strychnine** are much used in whooping-cough, incontinence of urine, and as external applications. Children are tolerant of these drugs, and larger proportional doses than those given to adults may be prescribed, if they are carefully watched. Children of one to two years of age may be given 1–2 drops of the tincture every two hours. Older children, 2–5 minims or more, though it is wise to begin with minimum doses and gradually increase the dose. Atropine is more dangerous, and is best avoided in young children. Children five years old and upward may be given minimum doses ($\frac{1}{16}$ grain) of the liquor, cautiously in-

creased. Temporary excitement and dilated pupils are the result of an overdose.

Cannabis indica.—Children bear this drug well; it is usefully added to bromide in 2½ minims to 20 minims doses of the tincture in whooping-cough.

Hypocistis.—Tincture of hypocistis is used as an anodyne in place of opium. In numerous cases is our depletion to it; it may be given in 5-minim doses to an infant a year old, 10 to 20 minims to older children.

Hyoscyamine sulphate is frequently substituted for the tincture, but, like atropine, it must be used cautiously, or not given at all to infants. ½ gr., cautiously increased to 2 gr., may be given to older children; larger doses have been given.

Hypocistis may be given with caution in the same doses as above, but is said to be more active.

PURGATIVES AND LAXATIVES.

Mercury and chalk by itself, or in combination with rhubarb and soda, is very frequently given as a laxative for infants a few months old, or when the stools indicate some irritant matters in the bowels. For this purpose ½–2 grs. may be given twice a day for a few days, or for two or three successive nights.

Calomel is preferable for older children on account of the smaller dose required; it may be given with soda, eucalypta, rhubarb, scammony, or jalapine. A grain may be given with white sugar to a child of one to three years, half a grain to an infant of six months, as a purgative. Half the quantity may be given with olive oil; thus—calomel, gr. ½; scammony resin, gr. ½; calomel, gr. ½; pulp, rhubarb, gr. ½; soda bicarb., gr. ½; calomel, gr. ½; eucalypta, gr. ½. Small pills made of calomel, gr. ½; ex. eucalypta, ex., gr. ½; calomel, gr. ½; ex. rhubarb, gr. ½, answer very well. Some prefer to give small doses of this drug, as gr. ½, repeated every hour till the bowels act.

Rhubarb forms a safe and non-irritative purgative, and is especially useful in combination with soda when a laxative and stomachic is required. It is extremely bitter, best covered by syrup of orange or spirits of nutmeg. Talc balls of these or soda are very convenient.

The syrup is a good preparation, especially in combination with an equal quantity of syrup of sumac, of which half a tea-spoonful to a spoonful is a dose. 'Mist. rhubarb' is much used as a laxative, given two or three times a day, especially in infants when the stools are 'putty-like' and non-moulding; thus, syrup. rhubarb, ℞; soda bicarb., gr. ½; aq. menth. pep., ʒj.

Inf. rhubarb with soda carb. and sp. sumac, aromat., forms a useful emulsion for infants—such as sp. sumac, aromat., ℞iij; soda bicarb., gr. ii; syrup. simple, ℞x; inf. rhubarb ad ʒj; sp. sumac, aromat., ℞iiss; syrup. simple, ℞x; inf. rhubarb, ℞v; inf. gent. co. ad ʒj.

Aloes.—Much used for constipation, either in the form of the aq. ext. or aloes in pills. Small pills containing 2 grains of aq. ext. of aloes are readily swallowed by children, or they can be divided with a little and given in jam. Aloes is useful in treating the constipation of infants and young children; 'anticonvulsant' 'talc balls,' containing aloes, gr. ½, belladonna ext., gr. ½, anycoline, gr. ʒi

Ipecac. gr. $\frac{1}{10}$, may be used, half a one being given to infants once or twice a day, mixed with a little white sugar.

Senna.—Mostly given in the form of the compound sennae powder, syrup, or infusion. The former is much used as a household medicine, quarter to one tea-spoonful being given mixed with a little water. The syrup is pleasant to take, being free from any gummies; a tea-spoonful is the usual dose; it is more effective when given with an equal quantity of syrup of chalk. The infusion is given in conjunction with some bitter, as strychnine or calamus, such as tea, strychnia, ℞; glyster, ℥ss; inf. sennae, ℥ss; inf. calambus, ad 5 j. 3. or 4 d. s. Old preparations of senna are apt to grip.

Calcareo sagrada is of much value in habitual constipation in infants and children. It may be given in syrup or some of the cherry, chocolate, lemon or orange. Some chemists prepare an extract from which the bitter principle has been removed. Five to 20 minims of the liquid extract once a day is the usual dose.

Podophyllum resin may be given in powder or 'tackled' form to infants and children suffering from constipation, beginning with $\frac{1}{2}$ gr. to $\frac{1}{4}$ gr. two or three times a day. Lb. podophylli 1 gr. $\frac{1}{4}$ ad 1 j. made by some chemists is a useful preparation, and may be prescribed with strychnine, bitters, acids, or alkalies.

Rubini, Hunyadi Jason, Carlsbad mineral water—a table-spoonful or more in warm water or milk, given before breakfast—very useful purgatives for children over four years of age.

EMETICS.

Pale. ipecac. is the best and safest emetic for children. It may be kept in the form of powder or the 5 grain 'tablets.' Five grains may be given, and repeated every ten minutes till vomiting is produced, in infants and young children. Ten grains may be given in one dose to older children, and repeated in ten minutes or a quarter of an hour. There is great difference in children with regard to the side with which they are made to vomit. In the later stages of anasarca or pneumonia, when the face and lips are pale or black, it is difficult to excite vomiting; indeed in this stage emetics are useless.

Apomorphia is apt to depress too much; it may be given $\frac{1}{2}$ — $\frac{1}{4}$ gr. tentatively, but not to infants.

Alum.—Half a tea-spoonful in honey or syrup is useful in whooping cough.

EXPECTORANTS AND DIAPHORETICS.

Ipecacuanha is usually given in the form of either ipecac. in doses of ℥ss to ℥ss to infants up to a year old, ℥ss to ℥ss to older children, repeated every two to four hours. It may be given with ℥ss of ag. mucrocoral and ℞ of glyster to the draught of water; or syrup pinal virgin. may be added. Vine ipecac. is apt to lose its strength by keeping.

Pale. ipecac. gr. is a useful expectorant (see Opium).

Antimony.—Mostly given as Vinum, in the same doses as vin. ipecac.; often prescribed with tart. amygdalic. Both ipecac. and antimony are better given in small doses, frequently repeated, than in increasing doses. In acute bronchitis or laryngitis it is often useful to push either ipecac. or antimony freely till sickness is

prolapsed, then to loosen the stool. From these drugs are given in the early stage of measles when stomach and bowels are loose.

Ermoline.—Dose $\frac{1}{4}$ to $\frac{1}{2}$ gr. is not often prescribed.

Liq. ammon. citratæ or **liq. ammon. acet.** is often combined with vitæ sperm. or vitæ acetum. in doses of $\frac{1}{2}$ to $\frac{1}{4}$ oz. for infants up to a year, $\frac{1}{2}$ to $\frac{1}{4}$ for older children, well diluted with syrup tilla. mentat., or great virgin. no cover the taste.

Syr. anodyn. arsenat.—Dose $\frac{1}{4}$ to $\frac{1}{2}$ is a drachm of syrup or glycerine and water for infants; $\frac{1}{2}$ to $\frac{1}{4}$ oz. well diluted, for older children.

Ammon. carbonat. = **chloridæ.** Dose $\frac{1}{2}$ gr. (sugar, v.) well diluted, and increased as far as possible by syrup anodyn., tilla, or silla.

Squilla.—Useful as a stimulating expectorant in bronchitis, when the secretion is free, faint riles being heard in the chest, and but little being coughed up. *Placebo.*—Dose $\frac{1}{4}$ to $\frac{1}{2}$ for an infant up to a year old; $\frac{1}{2}$ to $\frac{1}{4}$ for older children, repeated every four hours. Syrup = $\frac{1}{2}$ to $\frac{1}{4}$ oz. The syrup is often combined with ipecac. or ammonia, according to the stage of the bronchial affection.

Terebene.—Often useful as a stimulating expectorant; not often given internally to infants. $\frac{1}{4}$ to $\frac{1}{2}$ may be given or sugar to older children, or suspended in emulsion and syrup of lemon.

ANTACIDS AND CARMINATIVES

Alkalies and aromatics are frequently required in the dyspepsias of infancy. Of the former, soda bicarb. gr. iiii, magnesium carb. gr. ii, combined with syrup sugar and oil mint ad $\frac{1}{2}$ is useful; or soda bicarb. gr. iiii, tr. carle. vomica, $\frac{1}{2}$ g. tr. cardamom. ro. $\frac{1}{4}$ oz. ap. chloroform, $\frac{1}{2}$ oz.; sy. anodyn. ad $\frac{1}{2}$; given occasionally.

TONICS

Cod-liver oil takes the first place. It is best given after meals and in the form of an emulsion; some of the latter are to be obtained combined with lime salts. $\frac{1}{4}$ to $\frac{1}{2}$ oz. of the oil twice or three times a day is the dose for infants; $\frac{1}{2}$ to $\frac{1}{4}$ may be given to older children. Indigestion, constipation of intestines, and diarrhoea should be treated before cod-liver is given. Emulsions of warm cod-liver are often useful; the oil is applied on a sponge and the child clothed in a flannel nightgown.

Acids.—Dilute with rock $\frac{1}{4}$ to $\frac{1}{2}$ oz. ap. ad $\frac{1}{2}$ is often of much service the $\frac{1}{2}$ is indispensable. It may be combined with tr. chloam. ox., or decoc. cretaceæ and syrup limon.

Iron.—Often given as tonic freely $\frac{1}{4}$ to $\frac{1}{2}$ syrup ferri phos. oz. $\frac{1}{4}$ to $\frac{1}{2}$ or tr. ferri perchlorid. $\frac{1}{4}$ to $\frac{1}{2}$ in a wineglass of water at meal times. Ferri ox. ammon. dil. may be combined with alkalies and muc. rosat.

STIMULANTS

Alcohol necessarily takes the first place in the list, and is beyond all question of value in meeting acute disease when there is evidence of a flagging heart. It is not a matter of much importance what form of alcohol is selected, provided it is

of good quality. Brandy, in the form of mist. *sp. vini gallici*, is the one perhaps most generally useful. In hospital whiskey frequently takes the place of brandy for the sake of economy. Cognac, champagne, port wine, when so long diluted according to circumstances, may be used. Alcoholic stimulants are called for in the adynamic forms of scarlet fever, diphtheria, typho-paratyphoid, scarlet fever, and other allied conditions. The pulse is the best guide: a feeble, irregular, inconstant pulse calls for alcohol, mere rapidity of pulse does not. Drowsiness, if it does not contraindicate alcohol at least calls for caution in its administration, as overdosing with alcohol is apt to make the drowsiness more pronounced, especially that form due to a hyperæmic condition of blood. Delirium is often made worse by alcohol, especially if there is evidence of cerebral congestion, the congested vessels being irritated as in the early days of scarlet fever. In such cases opium or bromide answer better. Sweating is a signal for discontinuing alcohol, for a while at least. Unfortunately champagne, so useful as a rapidly diffusible stimulant, is apt to produce delirium. The amount of alcohol given necessarily depends upon circumstances: drachm doses of brandy, or even more, every hour, may be given in some cases of scarlet fever or typho-paratyphoid, with advantage even to young children. In adults alcohol is principally of value in colic and acute diarrhoea, and may be given well diluted with barley water, arrowroot, or milk. Port wine sometimes seems to agree better than spirit. In chronic disease alcohol is of less value than in acute, as the long-continued administration of it certainly has its evils, and is apt to produce dyspepsia and sluggish liver. In anæmia, scrofula, and tuberculosis the wine of St. Raphael, port wine, or perhaps very sometimes be given with advantage. [Also see *Hæmostatics*, under *Pernicious*, p. 795.]

FORCED FEEDING. GAVAGE.

Difficulties sometimes arise in feeding immature infants and those with cleft palates, the infant being too weak or sick, or the conformation of the mouth may render this impossible. In diphtheria, when the tonsils are enlarged and painful, or in paralysis of the pharynx, 'forced feeding' may have to be resorted to. For weakly infants the 'fontaine' feeding bottles have been devised, and the 'lactation pompes' of the French; there is, however, no difficulty in feeding a weakly infant by means of the ordinary boat-shaped feeder if held slightly inclined. Infants with cleft palates have to be fed by spoon, or by means of the 'Sutton-Harris method,' namely, a piece of India tubing attached to a glass syringe. In difficulty of swallowing from any cause this last method is the most generally useful. An ordinary glass syringe is taken and filled with milk, beef-tea, or other liquid nutriment, a piece of India-rubber tubing a few inches long is attached, the latter is passed into the mouth to the fork of the tongue, and the piston of the syringe slowly pressed from time to time, so that small quantities of fluid are swallowed from time to time. The tube need not be passed between the teeth; if they latter are clenched the tube may be passed between the cheek and the jaws. In cases where the pharynx is completely paralyzed a medium-sized India-rubber catheter must be passed through the nose into the pharynx and œsophagus, and food introduced into the stomach.

Forced feeding has also been used by Dr. Keiley, of New York, in cases of persistent vomiting in young infants, his experience being that food introduced directly into the stomach by a tube and forced in less readily rejected than if swallowed in the ordinary way. The method is as follows: The infant is held in a half-sitting position on the nurse's right arm; a soft India-rubber catheter, attached to a funnel of three or four ounces capacity by a rubber tube two and a half foot long, is gently introduced into the stomach, a half to two and a half ounces of liquid food introduced into the funnel; the latter is then raised and when empty gently withdrawn. This method of forced feeding appears to be more successful in infants than in older children. A preliminary stomach washing should precede the first forced feeding.

STOMACH WASHING.

Washing out the stomach is often a highly beneficial proceeding in the dyspepsia of infants, especially when vomiting of decomposing curd is a prominent symptom. The removal of curd which may have remained in the stomach for some days, as well as the acid mucus, is certain to be beneficial. The method of carrying it is the same in infants as in adults. An indurubber catheter as large as possible is passed down the pharynx into the stomach, and connected by means of an India-rubber tube, two or three feet in length, with a funnel. One or two ounces of warm two per cent. solution of borax is introduced into the funnel; the latter is raised so that the fluid flows into the stomach, and then lowered and inserted so as to allow of the return of the fluid contents of the stomach. This proceeding is repeated till the returning fluid is clear and sweet. Curdy material often escapes by the side of the tube.

Stomach washing is useful not only in the chronic dyspepsia of infancy, but also in the vomiting of acute gastric catarrh and other forms of vomiting.

ENEMATA.

Enemata are required for various purposes during infancy and childhood. A simple enema may be required to soften the bowels and clear away fecal matter which have collected in the large bowel; or they may be given for other purposes, such as that of applying local treatment to the mucous membrane of the colon, to replace an irrigant, or to destroy cysticercæ which are present there. Focal infections are also treated in this manner of administering drugs or nutrients.

Purgative enemata are generally given with a fountain syringe, and at a temperature of about 100°. They may consist of soap and water with the addition of almond, castor oil, or turpentine. When the latter is used a teaspoonful of oil, two teaspoonfuls of olive oil, and the yolk of an egg may be shaken up with four or five ounces of water for a child of two or three years. A large quantity of fluid may be injected if the fluid is required to reach the upper part of the large bowel. Some care is required, in giving an injection, so that it flows, avoiding all force. If it is required simply to unload the lower bowel, an injection of a teaspoonful of glycerine is all that is required. Enemata for the destruction of the cysticercæ are best given after a sharp purgative has been administered, in order to

drive the parasites as much as possible into the lower part of the intestines. For this purpose the turpentine injection referred to above answers very well, or half a pint to a pint of corrosive chloride of mercury (1 to 2,000) may be used. Reported 'irrigation' of the large bowel has been much practised on the Continent (*Mém. Régiment*) in various diseased conditions, such as constipation, dysenteric diarrhoea, catarrh of the large bowel, &c. Large quantities of water or various solutions are injected by means of an indiarubber tube with a nozzle to fit in the rectum, and a funnel. The forcing of a large quantity of fluid into the colon, especially in young children, is not always easy, on account of the straining and struggling which it is apt to produce, and tubule injection of fluid by means of raising the bowel with tube attached is not less dangerous. In irritable conditions of the colon warm mucilaginous fluids, such as decoction of arrowroot, two to four ounces, with two to five minims of laudanum, is useful, and resolves benumbing. The sublimate of oxide of bismuth, suspended in mucilage, and three or four ounces injected, is also useful. In some chronic cases, alum, zinc, sulphate, or nitrate of silver may be used. On the whole, opium is the most comforting to the patient.

Nutrient enemata may be given of peptonised beef-tea, or milk with brandy, or some other form of alcohol.

DIRECTIONS FOR USE OF DISINFECTANTS.

Solution A.—Chloride of lime, eight ounces; soft water, one gallon.

Solution B.—Liy. soda chlorinate, one part; soft water, five parts.

Solution C.—Corrosive chloride of mercury, four ounces; persulphate of potash, one dram; soft water, one gallon.

Stock bottles to be kept locked up, and labelled "POISON."

For use—One fluid ounce to be mixed with one gallon of water.

Use of A.—For the disinfection of excreta: Mix well with each stool half a pint of solution A, and allow it to stand for ten minutes before emptying it into the closet. Treat the vomit of fever patients similarly, and keep the spitto-cups of phlegmatic patients half full of the same solution.

Use of B.—(1) For the washing of hands and the cleansing of spatulas, thermometers, and other infected instruments; (2) for the thermometer to be kept in; (3) for the sponging of those dying of fever, previous to their removal to the mortuary; (4) *diluted with five times its bulk of water*, for the daily sponging of fever patients.

Use of C.—For the disinfection of clothes: The clothes to be washed in the solution for two hours, in an earthenware vessel, before being sent to the wash.

To Disinfect a Room.—Tightly close all windows, fire-places, and ventilators. Moisten powdered sulphur with spirit, place it in a shallow iron pan supported on a couple of bricks in a bowl of water; light it, and keep the room closed for ten hours. Three pounds of sulphur must be used for each 2,000 cubic feet of air space. N.B.—5 lbs. is necessary for each special ward. Then open all windows, &c., and wash the floors, walls, furniture, &c., with the following solution: Solution C, four fluid ounces; water one gallon, taking especial care to thoroughly

wash out all dust from window-sillings, screens, &c. Allow free ventilation for twenty-four hours.

LOEFFLER'S D-BACILLUS.

A small piece of membrane, exsiccation, or residue is broken up or smudged over a covered glass, and the latter dried by passing it several times through the flame of a spirit lamp, taking care not to overheat. A few drops of a solution of Loeffler's potash-methylene blue are placed on the dried exsiccation for five minutes; the cover glass is then again dried, a drop of balsam placed on it; it is then placed on a glass slide and examined with a $\frac{1}{2}$ oil immersion. The D bacilli may readily be recognised by the characters already given (p. 266). It must be admitted, however, that morphological characters are often not decisive.

Cultivations on liquid media and injections of the medium used for cultivations into guinea-pigs may be necessary in some cases of a doubtful nature.

FORMULÆ

The doses given are suitable for an infant of a year old unless otherwise noted.

DISORDERS OF DENTITION, p. 48

(1)

Potassi bromidi	gr. iiss	Chloralis	gr. ij
Ts. hyoscyami	℥ v	Potassi bromidi	gr. ij
Ext. glycyrrh. fl.	℥ x	Sp. anemon. aromat.	℥ ij
Aque	q. s. ad ℥ j	Syrupi pini Viag.	℥ x
<i>Every two or three hours, for an infant of seven months.</i>		<i>Every five or thirty hours.</i>	

(2)

Antipyrin	gr. j	Hydrargyri chlor. mit.	gr. ss
Elixir acetat.	℥ x	Eucapnia	gr. ss
Aque	q. s. ad ℥ j	Sacchar	gr. ss
<i>Every two hours till relieved.</i>		<i>The powder at night.</i>	

(3)

Sodii borat	℥ ss
Ts. myrtic	℥ ss
Glycerin	℥ j
Aq. rose	℥ j

To be painted on the gums or aphthous patches.

CATARRHAL STOMATITIS, p. 49

(4)

Potassi chlorat	gr. j	Potassi chlorat	gr. j
Syrupi acetat	℥ ss	Ext. cinchona fl.	℥ x
Aque	q. s. ad ℥ j	Elixir acetat.	℥ x
<i>Three times a day.</i>		<i>Three times a day.</i>	

Acidi borici	gr. x
Sp. thymol	℥ x
(1-10)	

Glycerin	℥ ss
Aque	q. s. ad ℥ j

To be painted on the aphthous patches.

Sodii borat	℥ j
Sp. thymol	℥ j
Glycerin	℥ j
Aque	q. s. ad ℥ viii

As a mouth-wash for children.

ACUTE TONSILLITIS, p. 69

<i>Tt. rosmari.</i>	℥j	<i>Soda salicyllata</i>	gr. x
<i>Liq. anise, simple. (Fr.)</i>	℥j	<i>Potassi citrat.</i>	gr. i
<i>Syrupi pini Virg.</i>	℥ss	<i>Syrupi pini Virg.</i>	℥ss
<i>Aqua</i>	q. s. ad ℥j	<i>Aqua</i>	q. s. ad ℥j
<i>Every three hours, for a child of five years.</i>		<i>Every three hours, for a child of five or six years.</i>	
<i>Iodi</i>	gr. ij	<i>Alumina</i>	℥ij
<i>Potassi iodidi</i>	℥j	<i>Acidi tartar.</i>	℥ss
<i>Glycerini</i>	q. s. ad ℥j	<i>Glycerini</i>	℥ss
<i>Prepared for enlarged tonsils.</i>		<i>Aqua rose</i>	q. s. ad ℥j
		<i>Prepared for enlarged tonsils.</i>	

FLATULENCE AND COLIC, p. 79

Magnesi carb.	gr. iiss	Chloralis	gr. iiss
Rhei	gr. i	Aq. liurocerat. (Fr.)	℥ss
Syrupi zingiberis	℥ss	Syrupi pini Virg.	℥ss
Aq. menth. pip.	q. s. ad ℥j	Aqua	q. s. ad ℥j
Every five hours, for an infant three or four months old.		Every three hours.	
(℥j—℥j) of sydeptic may be added to each dose if the infant is under close observation.)			
Soda bicarb.	gr. iiss	Hydrargyri cum creta	gr. i
Sp. anise, foetid. (Fr.)	℥ij	Pale. terebin et opii	gr. i
Sp. chloroformi	℥j	Sacchari	gr. i
Aqua menth. (Fr.)	q. s. ad ℥j	Fl. jule.	
Administered.			

(1)

VOMITING, p. 81

<i>Soda bicarb.</i>	gr. iiss	<i>Liq. chloroformi et anise, (Fr.)</i>	℥ss
<i>Aq. liurocerat. (Fr.)</i>	℥ss	<i>Tt. menth. virgata</i>	℥ss
<i>Sp. chloroformi</i>	℥j	<i>Glycerini</i>	℥ss
<i>Aq. menth. (Fr.)</i>	ad ℥j	<i>Aq. cam. (Fr.)</i>	ad ℥j
<i>Every four hours.</i>		<i>Every four hours.</i>	

SIMPLE DIARRHŒA, p. 83

(1)

<i>Op. ricini</i>	℥ss	<i>Soda bicarb.</i>	gr. i
<i>Acacia</i>	gr. x	<i>Bismuth. subcarb.</i>	gr. iiss
<i>Syrupi zingiberis</i>	℥ss	<i>Tingacanthæ</i>	gr. i
<i>Aq. menth. pip.</i>	ad ℥j	<i>Sp. chloroformi</i>	℥ss
<i>Every five hours.</i>		<i>Aq. cinnaom.</i>	ad ℥j
		<i>Every four hours.</i>	

(2)

(8)	(9)
Zinci sulfid gr. iiii	Acidi nitrici sol ℥j
Tragacanthæ gr. i	Syrapi acetosi ℥x
Sp. chloroformi ℥j	Dosati graduati rectific. (Br.) q.s. ad ℥j
Glycerini ℥xx	<i>Every four hours.</i>
Aq. menth. ad ℥j	

Every four hours.

(10)
Acidi nitrohydrochlorici sol. ℥j
Liq. pepsin ℥xx
Sp. chloroformi ℥j
Aq. menth. flor. ad ℥j

Three times a day.

CONSTIPATION (pp. 75 and 78)

(11)	(12)
Acidi sulph. aromat. ℥j	Podophylli gr. ʒ
Magnesi sulphatis ʒss	Euconymæ gr. ʒ
Ferri sulphatis gr. ʒ	Es. caryocarp. ʒi
Sp. chloroformi ℥v	<i>In Pelecanoside (Oppeheimer's) one or two</i>
Aque q.s. ad ʒss	<i>a day, for a child of six to twelve years.</i>

*Two or three times a day before meals,
for a child of ten or twelve years.
(Halsey Yoo.)*

Ts. belladonnæ ℥v	Es. caryocarp. liq. ℥x
Ts. scutellariæ ℥i	Ts. belladonnæ ℥v
Syrapi. ana ℥x	Elisir aromat. ℥x
Inf. perfoliæ co. (Br.) ad ℥j	Aque q.s. ad ℥j

*Three times a day, for a child of three
or four years. (Eustace Smith.)*

At bedtime.

ACUTE GASTRIC CATARRH, p. 75

Acidi hydrocyanici sol. ℥j	Sodii bicarb. gr. x
Sp. chloroformi ℥j	Aq. lirococtati (Br.) ℥xx
Aq. menth. flor. ad ℥j	Aq. menth. flor. ʒss

Every three hours.

Acidi citrici gr. x
Aque q.s. ad ʒss

*The citric and acid solutions to be
taken alternating every four hours, for
a child of ten or twelve years. (Halsey
Yoo.)*

ZYMOTIC DIARRHŒA, (pp. 83 and 84)

(13)	(14)
Sodii salicylatis gr. j	Moscæ gr. ʒ
Ol. menth. ℥xx	Anise gr. v
Aracis gr. v	Elisir aromat. ℥v
Syrapi. singulier ℥v	Aq. rosæ q.s. ad ℥j
Aq. menth. pip. q.s. ad ℥j	

Every two hours.

Every two hours.

Rhamni laxifolia gr. j	Salt gr. ʒ
Sp. annon. arom. ʒ ij	Pale. magistral. co. (Br.) gr. j
Pale. magistral. co. (Br.) gr. j	Elix. arom. ʒ ss
Sp. chloroformi ʒ j	Aqua q. s. ad ʒ ij
Aq. card. (Br.) ʒ ss ad ʒ ij	
<i>Every two hours.</i>	
<i>Every three hours.</i>	

CHRONIC DIARRHŒA, p. 104

(14)

Extracti hamamelidis	gr. iiss	Argent. nitrat.	gr. ʒ
Tr. catechu	ʒ v	Aqua	Oss
Syrup. tann.	ʒ v	<i>To be kept at all times.</i>	
Aq. camassoni	ad ʒ ij		

Every four hours.

CHRONIC GASTRO-INTESTINAL CATARRH, pp. 105 and 106

(15)

Sodii bicarb. gr. ʒ	Sodii bicarb. gr. ʒ
Pyren. gr. j	Hydrogyl. cam. crum. gr. j
Sacchari gr. j	Pale. rhei co. gr. j
<i>Half an hour after meals.</i>	
<i>Half an hour after meals.</i>	

(16)

Acidi nitrici dil. ʒ ij	Acidi spiræchlorici dil. ʒ ij
Liq. kieselæ et papæ co. ʒ ss	Liq. caryophylli et papæ co. ʒ ss
Sp. chloroformi ʒ ij	(Oppenheimer) ʒ ss
Aq. anastasi flr. ʒ ij	Elix. arom. ʒ ss
<i>Three times a day.</i>	
<i>Three times a day.</i>	
<i>(For children of seven to ten years.)</i>	

(17)

Sodii bicarb. gr. ʒ	Potass. bicarbonatis gr. ʒ
Sal. rhei (Br.) ʒ j	Tr. maris romicæ ʒ j
Elix. arom. ʒ ss	Aq. laurocerasi (Br.) ʒ ss
Aqua q. s. ad ʒ ij	Elix. arom. ʒ ss
<i>Three times a day before meals.</i>	
<i>Three times a day before meals.</i>	
<i>(For children of seven to ten years.)</i>	

(18)

Acidi nitrici dil. ʒ ij	
Ext. vinellæ fl. ʒ v	
Syrup. sacchari ʒ ss	
Aqua q. s. ad ʒ ij	
<i>Three times a day after meals, for children of seven to ten years.</i>	

TUBERCULAR ULCERATION OF THE BOWELS. p. 119

(20)		(21)	
Hydrargyri cum creta	gr. j	Fals. lixiv. co. (Rc.)	gr. i-ij
Fals. lixiv. et equi	gr. ij	Sacchari	gr. ij
<i>Every night, for a child of five years.</i>		<i>Every night, for a child of five to seven years.</i>	

(22)		(23)	
Emuls. ol. morrhine B.P.C.		"Byod" (Allen & Hanbury).	
<i>One to three teaspoonfuls three times a day.</i>		<i>One to three teaspoonfuls three times a day.</i>	

Byno-hypophosphites (Allen & Hanbury).
One to three teaspoonfuls three times a day.

CATARRHAL LARYNGITIS. p. 120

(24)		(25)	
Ammoon. et potassii tartariz.	gr. ij	Apoemorphine hydrochlor.	gr. ʒj
Liq. ramos. citr. (Rc.)	ʒ. s	Vin. opiac.	ʒ. ij
Elixir aromat.	ʒ. s	Elixir aromat.	ʒ. s
Aqua	q. s ad ʒj	Aqua	q. s ad ʒj
<i>Every four hours, for a child of two to three years.</i>		<i>Every four hours, for a child of two to three years.</i>	

BRONCHITIS AND BRONCHO-PNEUMONIA. pp. 221, 222, and 223

(26)		(27)	
Codexan	gr. j	Liq. morphine hydrochlor. (Rc.)	ʒ. ij
Elixir subman	ʒ. s	Acid. citr. dil.	ʒ. j
Aqua	q. s ad ʒj	Syrup. acetos.	ʒ. ss
<i>Occasionally, for a child of five or six years.</i>		Aqua	q. s ad ʒj
		<i>Occasionally, for a child of eight to ten years.</i>	

(28)		(29)	
Ammoon. carb.	gr. j	Oil. Gassia volat.	ʒ. s
Ti. digitalis	ʒ. j	Liq. camp.	ʒ. j
Syrup. scillæ	ʒ. ss	<i>To be rubbed on the affected part.</i>	
Aq. sacchi (Rc.)	ad ʒj		
<i>Every four hours.</i>			

(30)		(31)	
Ti. capsi	ʒ. ss	Capsi	ʒ. j
Liq. sapon.	ʒ. ss	Adipis lixiv. hydros.	ʒ. j
<i>To be applied to the affected part.</i>		<i>To be used to the affected part.</i>	

Vini spiritus	℥ ij
Liq. ammon. citratæ. (Br.)	℥ x
Syrup. iodo	℥ x
Aqua	q. s. ad ʒ j

Every four hours.

Potass. bicarb.	gr. j
Potass. iodid	gr. j
Ext. cinch. B.	℥ ij
Syrup. scilla	℥ x
Aqua	q. s. ad ʒ j

Three times a day.

Astimonil et potassii tartarat . .	gr. ʒi
Liq. morphin hydrochlor. (Br.)	℥ j
Aq. lauroceras. (Br.)	℥ x
Elixir aromatis	℥ x
Aqua	q. s. ad ʒ j

Every four hours, for a child of five to six years.

Sodii bicarb.	gr. x
Glyc. acid. carbolic	ʒ j
Aqua	q. s. ad ʒ j

*To be used with Siegel's strain spray.
(Barney Yeo.)*

ACUTE PNEUMONIA. p. 232

Liq. strychnia	℥ ʒ
Tx. digitalis	℥ ij
Sp. chloroform	℥ j
Aq. sacari. Bor.	ad ʒ j

Every four hours, for a child of two or four years.

Tx. acetic	℥ j
Liq. ammon. acet.	℥ xij
Aq. lauroceras. (Br.)	℥ x
Elix. aromat.	℥ x
Aqua	q. s. ad ʒ ij

Every four hours, for a child of two or five years.

BRONCHIAL ASTHMA. p. 245

Astimonil et potassii tartaratis . .	gr. ʒi
Liq. morphin hyd. (Br.)	℥ ij
Potass. iodid	gr. ij
Sp. chlor	℥ ij
Aqua	q. s. ad ʒ j

With an equal quantity of water every three hours, for a child of five or six years. (Barney Yeo.)

Pot. iodid	gr. ʒi
Ext. stramonii	gr. ʒi
Sp. chlor	℥ ij
Sp. ammon. aromat.	℥ ij
Aqua	q. s. ad ʒ ij

Three times a day (Barney Yeo, for a child of ten years.)

TUBERCULOSIS OF LUNG. p. 253

Cl. morrhua	ʒ ss
Ext. of malt	ad ʒ j

Three times a day.

Cl. morrhua	ʒ j
Cremati	℥ ij

Three times a day after food. (Very mucilag.)

"Dyco-hyposphosphites" (Allen & Hunsbury).

One to three teaspoonfuls three times a day.

Liq. iodi (Br.)	ʒ ss
Glycerin	ʒ j
Aqua	q. s. ad ʒ iiii

To be painted over the affected part.

SCARLET FEVER, p. 270

Potass. chlorat.	gr. v	Ammon. carb.	gr. v
Ext. clovea. fl.	℥ v	Ext. juncea. fl.	℥ v
Elixir aromat.	℥ xv	Tr. digitalis	℥ v
Aqua	q. s. ad ʒ ii	Syrup. rautat.	℥ xx
<i>Every four hours, for a child of five to eight years.</i>		<i>Every four hours, for a child of five to seven years.</i>	

MEASLES, p. 275

Antimony et potassii tartarat.	gr. ʒ	Tr. acetati	℥ j
Liq. ammon. acet.	℥ xx	Liq. ammon. (sat. (℥i)	℥ xx
Syrup. toli	℥ xv	Elixir aromat.	℥ v
Aqua	q. s. ad ʒ ii	Aqua	q. s. ad ʒ ii
<i>Every four hours, for a child of five years.</i>		<i>Every four hours, for a child of five years.</i>	

INFLUENZA, p. 298

Antipyretic	gr. ʒi-v	Soda salicylat.	gr. v
Sp. chloroformi	℥ ii	Liq. ammon. acet.	ʒ ss
Elixir aromat.	℥ x	Syrup. toli	ʒ iii
Aqua	q. s. ad ʒ ii	Aqua	q. s. ad ʒ ii
<i>Every six hours, for a child of six years.</i>		<i>Every six hours, for a child of six to eight years.</i>	

WHOOPIING-COUGH, p. 302

(25)

Tr. belladonnæ	℥ v-ss	Antipyretic	gr. ʒi
Ext. cannabis ind.	gr. i	Elixir aromat.	℥ x
Glycerol	℥ ss	Aqua	q. s. ad ʒ ii
Aqua	q. s. ad ʒ ii	<i>Every six hours, for a child of three to five years.</i>	

Pot. bicarbolat.	gr. v	Oxaline	gr. ʒi-ss
Liq. morphia hyd. (℥i)	℥ j	Sp. chloroformi	℥ j
Syrup. acilla	℥ xx	Aqua	q. s. ad ʒ ii
Aq. ammon. fer.	ad ʒ ii	<i>Every six hours, for a child of five to six years.</i>	

Bromocorn.

Two or three drops in a teaspoonful of water every four hours.

PERICARDITIS. p. 344

Pot. bicarb.	gr. x	Sodi. salicylat.	gr. x
Tr. acetic.	℥ ij	Liq. ammon. acet.	℥ ss
Sp. chloroformi	℥ v	Syrup. arant.	℥ ss
Aq. menth. flm.	q. s. ad ℥ ss	Aqua	q. s. ad ℥ ss

Every six hours, for a child of eight to ten years. *Every six hours, for a child of eight to ten years.*

CARDIAC TONICS. p. 346

Tr. ferri chlor.	℥ x	Ferr. et ammon. citr.	gr. x
Tr. digitalis	℥ v	Liq. strychnin. (Br.)	℥ ij
Sp. chloroformi	℥ v	Sp. chloroformi	℥ v
Aqua	q. s. ad ℥ ss	Glycerini	℥ ss
		Aqua	q. s. ad ℥ ss

Three times a day, for a child of eight to twelve years. *Three times a day, for a child of eight to twelve years.*

DIURETICS IN CARDIAC DROPSY. p. 346

Pot. acetatis	gr. x	Pot. iodid.	gr. ij
Syrup. squaril.	℥ ss	Tr. scilla	℥ v
Tr. digitalis	℥ v	Tr. strophanth.	℥ v
Sp. chlor.	℥ v	Sp. chlor.	℥ v
Inf. scarpa (Br.)	℥ ss	Aqua	q. s. ad ℥ ss

Three times a day, for a child of eight to twelve years. *Three times a day, for a child of eight to eleven years.*

CARDIAC STIMULANTS. p. 346

Sp. ethera co.	℥ x	Liq. strychnin. (Br.)	℥ ij
Tr. nuci. vom.	℥ x	Ex. coca fl.	℥ ss
Tr. benzoin. co.	℥ x	Sp. chloroformi	℥ v
Aq. carui (Br.)	q. s. ad ℥ ss	Aq. cinnamon.	ad ℥ ss

Every four hours or as required, for a child of eight to twelve years. (Barney Vee.) *Every four hours, for a child of eight to twelve years. (Barney Vee.)*

RHEUMATISM. p. 351

Sodi. salicylat.	gr. x	Potass. citrat.	gr. x
Pot. bicarb.	gr. x	Syrup. limonis (Br.)	℥ ss
Syrup. arant.	℥ ss	Aqua	q. s. ad ℥ ss
Aqua	q. s. ad ℥ ss		

Every four hours, for a child of ten years. *Every four hours, for a child of ten years.*

EPILEPSY AND CONVULSIONS. pp. 361 and 362

(31)

Potass. bromid.	gr. vii
Ti. belladonnæ	℥ ss
Sp. anisim. arom.	℥ x
Syrup. variat.	℥ ss
Aqua	q. s. ad ʒ ss

Three times a day, for a child of eight years.

Kali bromid.	gr. v
℞iæ coccol. sigrad.	℥ x
Sp. anisim. arom.	℥ v
Aqua	q. s. ad ʒ ss

Three times a day, for a child of eight years.

Potass. bromid.	gr. iiss
Chloral.	gr. iiss
Syrup. variat.	℥ ss
Aqua	q. s. ad ʒ j

For an infant of a year old.

Potass. bromid.	gr. v
Sodi. bicarb.	gr. v
Rhei	gr. j
Sp. chlorodoni	℥ v
Aqua	q. s. ad ʒ ss

Three times a day, for a child of eight years.

Potass. bromid.	gr. ii
Syrup. variat.	℥ ss
Sp. chlorodoni	℥ j
Aqua	q. s. ad ʒ j

Every two hours, for an infant of six months.

Chloral.	gr. iiss
Nepentho.	℥ j
℞iæ arom.	℥ ss
Aqua	q. s. ad ʒ j

For an infant of a year old.

NEPHRITIS. pp. 359 and 361

(32)

Potass. citrat.	gr. iv
Syrup. limonis (Dc.)	℥ ss
Aqua	q. s. ad ʒ ss

Every four hours, for a child of six to ten years.

℞iæ anisim. arom.	℥ ss
℞iæ digitalis	℥ x
Sp. chlorid.	℥ v
Aqua	q. s. ad ʒ ss

Every four hours, for a child of six to ten years.

Potass. tart.	gr. ss
Syrup. variat.	℥ ss
Aqua	q. s. ad ʒ ss

Every four hours, for a child of six to ten years.

Ti. ferr. chlor.	℥ ss
Acid. succ. dil.	℥ ii
℞iæ anisim. arom.	℥ ss
Sp. chlorid.	℥ x
Aqua	q. s. ad ʒ ss

Every four hours, for a child of six to ten years.

ECZEMA. p. 712

(33)

Hydrag. chlor. mil.	gr. j
Eucosmum	gr. j
Sacchari	gr. j

Hydrag. c. ros.	gr. j
Folv. rhei co.	gr. j
Sacchari	gr. j

Every other night, for an infant of six months old.

(32)	
Ol. menthae	℥i
Liq. potass. arsenat.	℥j
Mentha piperita	q. s.
Syrup. alant.	℥i
Aqua	q. s. ad ℥iv
Use two painful three times a day after food.	

(34)	
Calamine precipitat. (26.)	℥ij
Zinc. oxid.	℥ss
Ol. olive	℥i
Liq. calce.	℥j

(Crocket.)

(35)	
Acid. borac.	℥j
Ol. amygdala. express.	℥ss
Urea alb.	℥j
Glycer.	℥i
Aq. rose	℥x
Fl. rose.	

(36)	
Acid. salicylat.	gr. x
Zinc. oxid.	℥ij
Amyli	℥ij
Vaselin.	℥ss

(40)	
Ung. hydrarg. ox. flor.	℥j
Five per cent. sol. vaselin.	

(42)	
Glyc. plumb. acid.	℥ij
Liq. carbonat. deterg.	℥ij
Aq. rose	℥vi

(44)	
Gelatin.	25 parts
Zinc. oxid.	20 parts
Glycerol.	30 parts
Aqua	40 parts
Add two per cent. of salicyl.	

(33)	
Ichthcol.	℥ss
Carbol. oil	℥ss
To be applied on disc.	

(38)	
Liq. plumb. subacetat.	℥ss
Tr. opii	℥ij
Aqua	q. s. ad ℥v
Fl. rose.	

(39)	
Zinc. oxid.	gr. ss
Acid. carbolic.	gr. v
Oleum rose.	℥ss
Ung. linolat.	℥ij
Fl. rose.	

(41)	
Sulphur precip.	gr. ss
Lanolin.	℥ij
Vaselin.	℥ij
Zinc. oxid.	℥ij
Amyli	℥ij

(43)	
Ung. hydrarg. ox. rubr.	℥ss
Ung. zinc. oxid.	℥ss
Cerati petrol.	℥j

(43)	
Ung. plumb. liq.	℥ss
Ung. hydrarg. arsenic.	℥ss
Ung. zinc. oxid.	℥ss
Cerati petrol.	℥j

(45)	
Gelatin.	25 parts
Zinc. oxid.	20 parts
Aligh.	20 parts
Glycerol.	30 parts
Add two per cent. of salicylic acid.	

PSORIASIS, p. 742

(46)		(47)
Ol. cadini	5 ss	Chrysarobini
Ung. hydrarg. anacon.	5 ii	Guttapercha
Ung.	5 j	Chloroform

To be applied to the affected parts

TINEA, pp. 742, 743, and 744

(42)		(43)	
Sulphur precip.	5 j	Sod. borat	5 j
Hydrarg. ammoniacal	5 ss	Spir. camph.	5 i
Thymol	gr. x	Glycerini	5 ii
Vaseline	5 i	Aq. ment. Ros.	q. s. ad 5 iv
Ung.	ad 5 iv		

To be used as a hair-oil.

To be used as a liniment.

(50)		(51)	
Tr. cantharides	5 ii	Tr. cantharid.	5 ss
Tr. capivi	5 ii	Tr. capivi	5 ss
Tr. racis comar.	5 ss	Ol. rosat	5 ss
Ol. rosat	5 ii	Alcohol	5 iv
Ess. de Cologne	ad 5 iv		

To be used as a liniment.

*To be used as a liniment.**To be used as a liniment.*

SCABIES, p. 745

(52)	(53)
Sulphuris 3 j	Stearin 3 ss
Balsam Peru 5 ss	Ung. 5 ii
Ung. 5 j	

(48)

Naphthal	5 j
Ung.	5 ii

INDEX.

ABC

- Abies pectinatus, 219
- Abdomen, examination of, 77
- Abdominal aorta, 118
- Abdominal pain in spinal disease, 669
- in puer. 749
- section in intracranial, 372
- wall, layers of, 145
- Aboritive paranasals, 228
- Abscess, acute glandular, 351
- alveolar, 62, 607
- cerebral, 476, 711
- chronic, 386, 785
- glandular, 351
- hepatic, 180
- iliac, 423
- in bone, 590 et seq., 785
- in hip disease, 626, 785
- of the liver, 180
- of the lung, 231
- mediastinal, 848
- peritubercular, 644, 645
- peritonsillar, 23
- periglandular, 382
- peritoneal, 690
- peritonsillar, 121
- peritoneal, 118
- peritubercular, 117, 120, 125, 135
- post-pharyngeal, 23
- puer. 620, 675
- residual, 667
- retro-pharyngeal, 75
- spinal, 668-674, 795
- Absence of mouth, 169
- of tongue, 167
- Accidental iliocecy, 521
- A. C. E. mixture, 765
- Acetabular disease, 642, 645, 665
- Acetabulum, "travelling," 641
- Accidents with anaesthetics, 770
- Acquired clubfoot, 687
- hernia, 142
- syphilis, 427
- talipes, 687

AMP

- Arthro-clavicular joint, disease of, 653
- Arise adenitis, 381, 383
- — simple, 383
- atrophic paralysis, 339
- bronchitis, 210
- cellulitis, 65
- cerebral paralysis, 473
- circumscript osteomyelitis, 600
- epiphysis, 600
- gastro-intestinal catarrh, 80
- generalised broncho-pneumonia, 125, 219
- glandular abscess, 353
- hip disease, 642, 768
- meningitis, 409
- miliary tuberculosis, 375
- osseous, 590
- nephritis, 558
- orchitis, 384
- osteomyelitis, 591, 600
- pericarditis, 596
- peritonitis, 113
- rickets, 401, 778
- simple acute synovitis, 669
- suppurative arthritis of infants, 622
- tubercular synovitis, 604
- yellow atrophy of liver, 174
- Acutely inflamed bacilli, removal of, 71
- Adison's disease, 550
- Adenitis, acute, 379
- tubercular, 379
- Adenoids, post nasal, 74
- Adenomatous recti, 155
- Adjacent abscess, 645
- Adolescence, effects of, 414
- Age for operation in knee-joint, 250
- Al-passage, foreign bodies in, 205
- Albuminuria in dyspepsia, 269
- Alimentary canal, 5
- Alperia arista, 745
- Alum in whooping-cough, 384
- Alveolar abscess, 62, 607
- Amputation of hip-joint, 666

ANT

- Amputation, intra-uterine, 693, 694
 — primary, 749
 Ananias's operation, 144
 Anemia, 359, 760
 — idiopathic, 761
 — lymphatic, 760
 — pernicious, 760
 — splenic, 764
 — with edema, 760
 Anisakiasis, 763
 Anal condylomata, 155
 — fissures, 155
 — fistula, 154
 Anastomosis, varicose by, 358
 Anchyloglossia, 537
 Anchylosis of jaw, 537
 Anasarca, 523
 — by anastomosis, 358
 — of middle cerebral artery, 358
 Angina Ludovici, 386
 Angina, cavernous, 350
 — lymphatic, 358, 316
 — simple, 350
 Angular curvature of spine, 664, 709
 Ankle, eversion of, 633
 — (ankle) diseases of, 648
 Anterior yolk-membrane, 533
 Antisepsis, 703, 778, 784
 Antipyretics, 775
 Aorta, artificial, 144
 — imperfect, 142
 — alteration of, 155
 Aortic regurgitation, 343
 Aphasia, 525
 Aphthous stomatitis, 59
 — vulgaris, 523, 774
 Apoplexy neonatorum, 18
 Appendicular peritonitis, 117, 120, 125, 231
 Appendix, removal of, 121
 Arm, fracture of, 734 *et seq.*
 Arrest of growth after epiphysitis, 696
 — in rickets, 407, 409, 423
 — after injury, 153, 154, 250
 Arterial aneurysm, 343
 Arteriovenous aneurysm, 315, 316
 Arthritis, 31, 454
 Arthrodesis, 622 *et seq.*
 Arthritis of infants, acute suppurative, 622
 — rheumatic, 620
 Arthrodia, 627
 Artificial muscle, 583, 590, 594, 703
 Ascariasis, 200
 Asystole, 311
 — in cirrhosis, 275

BOR

- Asphyxia neonatorum, 15
 Aspiration for empyema, 241
 Asthma, 345
 Astronomy, 703
 Asthenia, 477, 493
 Astropia, 95
 Atlasto-axial disease, 626, 701
 Atresia ani, 142
 — uret., 250
 Atrophy of face, 169, 693
 — of testis, 453
 — of uterus, 98
 — of jaw, 537
 — of liver, acute yellow, 174
 — simple, 61
 Atrophia, disease of, 707
 — supernumerary, 184
 Auscultation, 153
 Aural, correction of, 17
 Axi, traction for hip-disease, 655, 700
- BACKEWARD children, 523
 Balaia, 570
 Barking water, 48, 798
 Barwell's artificial muscle, 583, 590, 594
 Basal ganglia, tumours of, 465
 Balaia in whooping-cough, 332
 Balaia of pathology, 705
 Balaia's osseous system, 47
 Balaia, 142
 — tongue, 157
 — skull, 159
 Balaia, congenital stricture of, 172
 — section of, 6
 Balaia, circulation after, 4
 — dilation incident to, 15
 — neck, 549
 — palat., 478
 Balaia, calculus of, 562
 — extrusion of, 570
 — inflammation of, 566
 — vagus, 466
 — tubercular disease of, 566
 — tumors of, 566
 Balaia, 33, 257
 Bleeding, 351
 — after excision of tonsils, 71
 Bleeding, 30
 Blood, amount in body, 4
 — of infant, 4
 Body weight, 9
 Bone grafting, 700
 Bones, diseases of, 550, 783
 — syphilitic disease of, 433 *et seq.*
 Botic acid in epithelium, 703

BOW

- Bowen, chronic obstruction of, 134
 — congenital obstruction of, 140
 — tubercular ulceration of, 136
 Bowing, 405, 411, 760
 Bowk, abscess of, 467, 711
 — atrophy of, 458
 — congestion of, 459
 — cyst of, 460, 478, 482 of *ov.*
 — development of, 7
 — fever, 444
 — hypertrophy of, 457
 — scrota of, 460
 — sclerosis of, 458
 — subcutis of, 450, 454
 — turgor of, 458, 504, 711
 — syphilis of, 435, 455, 484
 — tumours of, 460
 — weight of, 7
 Bronchial cartilages, 169
 — dermoid cysts, 269, 471
 — fistula, 169
 — — median, 170
 Bronchic rash, 712
 Bronchial glands, adenoma of, 248
 — disease of, 246, 711
 Bronchiectasis, 212
 Bronchitis, 210
 — acute, 210
 — chronic, 213
 Bronchocoele, 726
 Broncho-pneumonia, 214
 — in measles, 270
 — acute generalised, 219
 — chronic, 217
 — disseminated, 203
 — mixed organismic in, 220
 — from tuberculosis, 271
 Bunt de pot III, 183
 Bryant's splint, 664, 660
 Burns and scalds, 760
 Burns of Plictermann, 164
 Burne in club-foot, 665
 Bursitis, 694

Cecal calculus, 145

— bursitis, 147

Calcaneo-astragaloid disease, 635

Calculus of kidney, 557

— in female, 71

— urethral, 563, 569

— vesical, 562

Callian's operation, 144

Calveel fungation, 696

Canal of Hiss, 170

Canceroma, 64

CHD

- Capillary normis, 349
 Caput succedaneum, 21
 Carles acid in whooping-cough, 322
 Carcinoma of stomach, 108
 Cardiac dilatation, 247
 — — in nephritis, 268
 — rupture in diphtheria, 290
 Caries, 589
 — of spine, 664, 760
 Carpo-pedal contractions, 477
 Cartilages, bronchial, 157, 169
 Cartilaginous tumours, 711, 721
 Cavities of bronchial glands, 246, 711
 — of lung, 217, 249
 Catarrh, acute gastric, 84
 — — gastro-intestinal, 66
 — of bronchial tubes, 210
 — chronic gastro-intestinal, 98
 Catarrhal processes, 174
 — laryngitis, 189
 — conjunctivitis, 400
 — tonsillitis, acute, 64
 Caudal appendage, 531
 Cavities angios, 349, 316, 710
 — cancer, 349
 Cellulitis, deep vertical, 366
 Cephalhematoma, 20
 Cephalohydrocele, 348
 Cephalic abscess, 741
 Cerebellum, tumour of, 462
 Cerebral abscess, 466, 711
 — cyst, 461, 478, 482
 — hemorrhage, 470
 — lesions, surgical treatment of, 468, 711
 — peritonitis, acute, 479
 — pyramidal, 709
 — softening, 461, 464
 — tumour, 460
 — congestion, 479
 Cerebro-spinal meningitis, 447
 Cervical cellulitis, 85, 346
 — paraplegia, 679
 Chest, examination of, 280
 — form of, in infancy, 166, 779
 — injuries of, 749
 Chemo-static respiration, 443
 Children, 711
 Child-covring, 184
 Childhood, 7
 Chloroform, 764
 Chlorosis, 360
 Cholera infantum, 91
 Chorea, 481
 — insensory, 498
 — paroxysmal, 487
 — peripheral neuritis, 497

DEX

- Deaf-mutism, 535
- Deafness, 708
- Deep cervical cellulitis, 556
- Delirium of oesophagus, 721
- in rickets, 407, 779
- treatment of, 417, 780
- rickets, operations, 418
- of anididism, 145
- Deformity from thumb-sucking, 159
- Degenerated myum, 354, 355, 367
- Degeneration, reaction of, 541
- Dental formula, 12
- Dentigerous cysts, 725
- Destitution, ailments of, 55
- course of, 12
- second, 35
- Depressed sores, 355
- Derbyshire sick, 705
- Dermatitis gangrenosa, 742
- Dermoid cysts, 155, 171, 550, 558, 717
- of lip,
- — brachial, 261
- — of scrotum, 155
- Developmental disease, 521
- Deviation of nasal septum, 704
- Diabetes insipidus, 319
- mellitus, 318
- Diaphragmatic hernia, 251
- Diarrhoea, 81
- chronic, 200
- dysenteric, 96
- febrile, 82
- in measles, 276
- summer, 66
- symptomatic, 85
- Diast of infants, 55, 54, 796, 797
- milder for indigestion, 400
- Digestive system, diseases of, 55
- Diphtheria in heart-disease, 318
- Dilator, manual, 200
- Dilatation of the ventricles, 343
- Diphtheria, 263
- anthrax, 764, 771
- diagnosis of, 245
- pathology of, 245
- treatment of, 242
- albuminuria of, 284
- cardiac syncope in, 200
- epidemics of, 254
- infectious nature of, 254
- laryngeal, 284
- malignant, 255
- mild, 255
- pharyngeal, 256, 772
- pneumonia in, 290
- gangrene in, 294

EAE

- Epilepsia, bacillus of, 263
- nasal, 268
- wound, 259
- pruriginosa in, 292
- vesicae in, 258
- pseudo, 294
- Epilepticus group, 192, 223
- infection of nasal, 31
- paralysis, 290
- sore throat, 294
- Direct tubercular infection, 237, 663
- Disease of bones, 319, 705
- of calcaneo-scapulo-humeral joint, 635
- of hip joint, 449, 708
- of metatarsus, 503, 506
- of phalanges, 609, 636
- of sacrum, 490, 676
- of scapulo-humeral joint, 637
- of vertebrae, 581
- Disinfectant of joints, 612, 765
- of liver, 171
- of nose, 703
- of respiratory system, 252
- of retroperitoneal glands, 378
- Dislocations, 695, 704
- Dislocation of elbow, 729
- of hip, 759
- — congenital, 701, 703
- of patella, 704
- of shoulder, 704
- — congenital, 700
- Displaced nasal septum, 704
- Disseminated broncho-pneumonia, 213
- myelitic, 336
- Distribution of lymphatic glands, 310
- Diverticula of oesophagus, 74
- Diverticulum, Meckel's, 24, 246
- Double anastomosis, 696
- hip disease, 669
- hip spica for spinal cases, 673
- anastomosis, 554
- Docuages, 704
- "Dry bellyache," 169
- Duck-skin, 600
- Ductus arteriosus, 2
- — obliteration of, 4
- venous, 2
- Dyspeptic diseases of infancy, 78
- Dysenteric diarrhoea, 96
- Dysphagia in normal disease, 669
- Eae, chronic of mouth of, 707
- diseases of, 707
- foreign body in the, 707
- Early life, periods of, 1

ECL.

- Eclampsia, 368
 Ecopia visceris, 570
 Eczema, 749
 Eileus, disease of, 616, 787
 Embolism, 480
 — in nephritis, 266
 — in testicles, 683
 Emphysema, 211
 — in tracheostomy, 203
 — in utero, 219
 Empyema, 224
 — from necrosis of rib, 396
 — surgical treatment of, 242
 Encephalocoele, 331
 Encephaloma, 715, 723
 Encysted hernia, 347
 Endocarditis, 338
 Enlarged spleen, 363, 367, 434
 Enteric fever, 295
 — abdominal symptoms in, 301
 — bronchitis and pneumonia in, 304
 — contagious nature of, 295
 — diagnosis of, 304
 — epistaxis in, 302
 — haemorrhage in, 302
 — incubation of, 299
 — membranous tonsillitis in, 304
 — mortality of, 295
 — perforation of intestine in, 303
 — peritonitis in, 303
 — pyrexia in, 303
 — rash in, 302
 — relapses in, 302
 — symptoms of, 299
 — temperature of, 300
 — treatment of, 305
 — — tuberculous in, 304
 Evaluation of skull, 77
 Enteritis, 667
 Epidemic influenza, 225
 Epidemic tonsillitis, 67
 Eklipser, 487
 — replacing for, 502
 — post-hemorrhagic, 499
 Epiphyseal separation of, 722
 — union of, 257
 Epiphysitis, 592, 602 *et seq.*
 — acute, 602
 — syphilitic, 424
 Erysipelas, 572
 Eritema, 706
 Erythema of kidney, 353
 Erision, 627
 — of ankle, 693
 Eruptions, drug, 747
 Erysipelas, 512, 520, 760

EYS.

- Erythema, 737
 — maliforme, 591, 759
 — nodosum, 590, 739
 — pernio, 737
 — scabuliforme, 738
 Eschschol's operation, 244
 Ethos, 760
 Examination of chest, 192
 Exanthematic peritonitis, 598
 — in utero, 594, 600
 Exostosis, 629
 — of ankle, 633
 — of hip, 647, 701
 — of knee, 629, 749
 — of tibia, 634
 — — for club-foot, 665
 — of wrist, 762
 Excision of nasal, 30
 Exfoliation, 746
 Expectoration, 752
 Extension for hip disease, 651, 668
 External os of ear, closure of, 707
 Extravasation of urine, 563, 569
 Extrusion of bladder, 570
 Eyes, syphilitic affection of, 435
 Face, atrophy of, 469, 693
 — hypertrophy of, 669
 Facial paralysis, 746
 Facial rickets, 118, 145
 False teats, 488
 — hydrocephalus, *sq.* 490
 — in utero, 529
 Fasting girls, 519
 Fat diarrhoea, 52
 Fatty degeneration, scale, 88
 — liver, 375
 — pancreas, 743
 Fetus, 745
 Fertilisability in live-bp cases, 519
 Feeding, artificial, 43, 796, 797
 — bottles, 57
 — of infants at the breast, 35
 Ferment vomia, 122
 Femur, fracture of, 745, 755
 Ferusich, 773
 Fever, infantile intermitent, 364
 Feverishness as a symptom, 254
 Fevers, 254
 Fibrocellular tumour of tongue, 168
 Fibrous tumours, 745
 Fingers, contraction of, 693
 Fixation of the anus, 115
 — of mouth in syphilis, 420 *et seq.*
 — of stomach, 700

FIS

- Fistula, in, 200, 254
 — buccal, 169
 — buccal, 215
 — buccal, 231
 — buccal, 215
 Flaccid, 684, 799
 — in gum vulgum, 423
 Flaccid, 79
 Fatal pericarditis, 356
 — stroke, 400
 Flaccidities, class of, 7
 Flaccid ovine, patent, 327
 Flaccid straightening of limbs, 419, 750
 Foreign bodies in the alveolar, 405
 — — — ear, 707
 — — — nose, 303
 — — — oesophagus, 25
 Fracture after necrosis, 591
 Fractured base of skull, 749
 Fractures, green-stick, 794
 — of long bones, 343, 352
 — of pelvis, 349
 — of skull, 748, 749
 — ununited, 350, 354
 Friedländer's disease, 535
 Frontal lobe, tumours of, 466
 "Fungus of the nail," 29
 Fungus of the nail, 347

- Gastric of the lung, 233
 — of the nail, 31
 Gastric juice, 5
 — catarrh, 85
 — pneumonia, 224
 Gastro-intestinal atrophy, 95
 — — catarrh, acute, 80
 — — chronic, 95
 — — enteritis, 55
 — — hemorrhage, 25
 Gastritis, 35
 Genital peritonitis, 114
 — surgical tuberculosis, 357
 — tuberculous, 373
 Genital organs, hemorrhage from, 29
 Genito-urinary diseases, 310
 — organs, malformation of, 370
 Genic exostosis, 413
 — recurrent, 609, 700, 714
 — vulgum, 410, 750
 — — degree of, to measure, 416
 — from ticks, apparatus of, 410, 750
 — virus, 413
 Genio-oste, 357, 720
 Genio-pain, 669

HIS

- Gland fever, 355
 Glands of groin, enlargement of, 348, 645, 651
 — lymphatic, distribution of, 350
 — retroperitoneal, disease of, 325, 371
 — testicular, disease of, 345, 355
 — mesenteric, disease of, 370
 Glandular abscess, acute, 353, 381, 384
 Glottis, width of, 205
 — spasm of the, 354
 Gumbo, 726
 Gonorrhea, 36
 Gonorrheal rheumatism, 622
 "Gonorrhea joint," 419
 "Gonorrhea nail," 493
 Green-stick fractures, 400, 419, 405, 750
 Growing fever, 604
 Growth, arrest of, 419, 415, 414, 546, 752, 754, 756, 758
 Gummata, scrofulous, 353

- Hemarthrosis, 364
 Hematoma of sternum-mastoid, 25, 691
 — occipital, 25
 Hematuria, 590
 Hemoglobinuria, 345, 390
 — intermittent, 347
 Hemophilia, 25, 363
 Hemorrhage, 281
 — cerebral, 420
 — gastro-intestinal, 25
 — genital organs, 29
 — uterine, 470
 — mesenteric, 411
 — newly born, 25, 20
 — umbilical, 31
 Hemorrhagic diathesis, 27
 Hemorrhoids, 354
 Hilar flexion, 709
 — vulgum, 709
 Hammer toe, 700
 Harelip, 157
 — cleft, flexible vitally is, 759
 — median, 266
 — operations, age for, 260
 Healed, 312
 Head, cold in the, 305
 — injuries, 745
 Head-banging, 309
 — nodding, 309
 — shaking, 309
 Healing in the newly born, 8
 Heart, diseases of, 321
 — dilatation of, 343
 Heart-disease, chronic, 339

HEA

- Heart-disease, congenital, 326
 — treatment of, 344
 Hemichorea, 487, 493
 Hemiplegia, 473 *et seq.*
 — from exertion, 317
 — causes of, 474 *et seq.*
 — infantile, 473
 — from meningitis, 443
 Herptic ulcers, 180
 Hepatic, interstitial, 172
 — syphilitic, 172, 174
 Hepatosplenitis, 146
 Hereditary idiosyncrasy, 433
 — syphilitic, 425
 Hemorrhoids, 375
 Hernia, acquired, 147
 — congenital, 147
 — cerebral, 429
 — diaphragmatic, 149
 — encysted, 147
 — femoral, 147
 — food-stuff, 147
 — inguinal, 147
 — of ovum, 145
 — and undescended testis, 374
 — inguinal, 147
 — of the ovary, 145, 154
 — radical cure of, 152
 — rectal, 144
 — strangulated, 147
 — transitory of, 147
 — umbilical, 147
 Herpes vector is spinal disease, 690
 Hides vomer, 150
 — of abdominal wall, 146
 Hyaline, 639, 198, 790
 — acute, 642
 — double, 663
 — dilation of, 719
 — — congenital, 701, 705
 — reflex muscular spasm, 719
 — results, 700
 Hic, usual of, 870
 Hodgkin's disease, 316
 Hollow jaw-dust, 540
 — clay-dust, 550
 Home-shed kidney, 510
 Hydatids of the liver, 186
 Hydranephrosis, 531
 Hydrops, 181, 186
 — of the neck, 667, 327, 328, 715
 Hydrocephalus, 477, 442
 Hydrocephalus, acute, 454
 — chronic, 444
 Hydrocephalus, fatal, 477, 478
 — and spine bifida, 430

HYD

- Hydrocephalus, 157
 Hygroma, 162, 327, 328, 316
 Hyman, imperforate, 574
 Hypoglycemia in peritonitis, 230
 Hypertrophy of lania, 455
 — of face, 169
 — of lania, 375
 — of tonsils, 69
 Hypoglossal, 375
 Hypospadias, 510
 Hysterical choera, 487
 — pains, 638
 — vomiting, 80
 Hysterocele, 477, 491
 ICHTEON venereum, 21
 Idiocy, 324
 — cerebral, 321
 — syphilitic, 324
 Idiopathic anemia, 351
 Idiopathic dactylitis, 30
 Idiopathic, acute, 66
 Iliac abscess, 145, 154
 Imitation in chorea, 456
 Imperforate anus, 146
 — hymen, 575
 — rectum, 147
 Impetiginous eczema, 734, 735
 Impetigo contagiosa, 730
 Implication of nerve in reflex, 713
 Incontinence of urine, 367
 Indigestion, diet table in, 104
 Infancy, definition of, 2
 — dyspeptic diseases of, 74
 — mortality in, 15
 Infant, weight of, 9
 Infantile clonus, 86
 — convulsions, 502
 — hernia, 147
 — intermittent fever, 246
 — leucorrhoea, 518, 718
 — oedematous, 406
 — paralysis, 519, 607
 — — and hip-disease, 460
 — scurvy, 201, 718
 Infants, diet of, 95
 — feeding of, 18, 705, 707
 Inflammatory diseases, 24
 Inflation of intestine in intussusception, 189
 Influenza epidemic, 291
 — bacillus of, 295
 — treatment of, 295
 — relapses in, 295
 — pneumonia in, 297

INF

- Infamnia**, scrofular tub. is, 297
 — gonorrhoea is, 297
 — leucorrhoea is, 297
Infantile adenitis, 644, 645, 651
 — catarrh, 744
 — keritis, 747
Injections by intranasal, 129
Injuries of soft parts, 369
Intermittent fever, infantile, 245
 — hemoglobinuria, 347, 359
Interstitial hepatitis, 777
Intestinal fistula, 125
 — "kinks," 114
 — obstruction, acute, 123
 — warts, 109
Intoxina, congenital obstruction of, 140
Iris uerine amputation, 695, 697
 — life, 1
 — respiration, 3
Irritation of larynx, 206, 773
Intranasal, 125
 — abdominal section is, 133
 — chronic, 133
Irrigation of the bowel, 125
 "Irrigated" is, 504
Irritable mamma, 180
 — rugose bladder, 560

JANUARY, catarrhal, 174

- of infant, 25
 — malignant, 323
 — in pneumonia, 210
Jaw, ankylosis of, 632
 — cysts of, 725
Joint disease, pyemic, 620, 731
 — serous, 523
Joints, diseases of the, 419, 731
Juvenile, 672, 731

KIDNEYS, congenital anomalies of, 110

- diseases of, 550
 — kinks of intestine, 114
Knee, diseases of, 113 of sup., 250
Knee-knee, 110, 115 of sup., 730
 — from vascular spasm, 416
 — rickets, 110
Kyphosis, 401, 425

LARYNX, hypertrophy of, 178

- nerves of, 178
 — ulceration of, 178, 179
Laryngeal, affections of, 178
Laminectomy, 616, 791

LUN

- Laryngeal paralysis**, 177
Laryngeal diphtheria, 179, 273
Laryngismus stridulus, 179, 297
Laryngitis, catarrhal, 179
 — chronic, 200
 — spasmodic, 155
Larynx, laryngeal is, 177, 273
 — papilloma of, 200
Latent meningitis, 440
Latent carcinoma of spleen, 244, 281, 703
 — treatment, 711
 — from cancer, 660, 703
 — meningococci, 128
Late rickets, 214
Leg, fractures of, 190 of sup., 754
Length in infancy, 20
Leptocystis, 671
Leucocytæmia, 369
Leucorrhoea, infantile, 583, 138, 734
Leukemia, 767
Lichen scrofulaceus, 740
 — anophthalmus, 57, 141
 — molluscum, 740
Lincrois, 114
Life, intralaryngeal, 1
Limb, injuries of, 744
 — with amputation of, 673, 703
 — rickets deformities of, 407 of sup., 731
Lip, cleft of lower, 110
Lipoma, 739
Lipomatous, 110
Lithemia, 552
Lithotomy, 693
Lithotripsy, 369
Little's, 114 of sup., 683
Little's operation, 141
Liver, abscess of, 150
 — acute yellow atrophy of, 174
 — cirrhosis of, 177
 — division of, 178
 — enlargement of, 172
 — examination of, 172
 — fatty, 173
 — epithelium of, 178
 — lymphadenoma of, 150
 — size of, 172
 — syphilitic affections of, 177
 — tuberculous of, 179
 — tumour of, 178
Lobar pneumonia, 225
Lobelia in whooping-cough, 322
Local anæsthesia, 754
Loos of blood, 711
Louis's angina, 586
Lumbar colotomy, 144
Lungs, abscess of, 234

LUN

- Lungs, excretion of the, 246
 — chronic tuberculous of, 241
 — collapse of, 259
 — gangrene of, 255
 — syphilitic affection of, 259, 263
 — vital capacity of, at different ages, 4
 Lupus, 253, 246
 — hypertrophic, 253
 Lymphadenoma, 229
 — of lymphatic glands, 228
 — of liver, 230
 Lymphangiomata, cavernous, 236, 226
 — cystic, 257, 257, 216
 Lymphangitis, reticular, 279
 Lymphatic anemia, 236
 — glands, distribution of, 236
 — trunks, 236, 216
 — varic, 257
 Lymphoma, 224
 Lymphosarcoma, 224

- MARTIN'S operation, 433, 271
 Macrocephaly, 166
 Macrogloma, 167, 255, 257, 208
 Maculoma, 216
 Macula, pigmented, 252
 Malarial fever, 283
 Malformation of genito-urinary organs,
 270
 — of limbs, 664
 — of nose, 202
 Malignant junction, 224
 — disease of stomach, 208
 — polyp of nose, 202
 Malnutrition, 98
 Malunion of fractures, 259, 255
 Mamma, movable, 200
 Mammary cancer, 216
 Manipulation for club-foot, 684, 209
 Marasal disease, 209 *cf sup.*
 Mastectomy, 277
 Maxillary impression, 255
 Measles, 272
 — incubation of, 274
 — laryngitis in, 276
 — eruption in, 275
 — mortality in, 275
 — treatment of, 277
 — broncho-pneumonia in, 276
 — glandular enlargement in, 276
 — diagnosis of, 277
 — medical anatomy of, 277
 — micro-organisms in, 275
 — quarantine in, 275
 — tuberculous in, 277

MOR

- Morbus arterialis, contraction of, 514
 Meckel's diverticulum, 30, 126
 Mesenteria, 6
 Median bronchial fistula, 170
 — hare-lip, 116
 Mesenteric abscess, 246, 248
 Mesenterio-pericarditis, 246
 Mesotheli, trunks of, 263
 Metastatic hemorrhage, 273
 Mesothelioma (temporal), rupture of, 268
 Mesothoracic cramp, *see* Diphtheria
 — laryngitis, 272
 Meningeal hemorrhage, 271
 — — post partum, 272
 Meningitis, acute simple, 244
 — cerebro-spinal, 247
 — chronic, 253
 — latent, 248
 — in pneumonia, 250
 — purulent, 248
 — simple, 244
 — spinal, 233
 — tubercular, 248
 — syphilitic, 245, 253, 258
 — tubercular, 240
 — ventricles in, 247
 Meningocele, 231
 Meningo-encephalitis, 258
 Mental affections in childhood, 519
 — defect affecting speech, 218
 — stream, 241, 270
 Menstrual disease, 254, 256
 Metatarsophalangeal disease, 156
 Methods of operating for hare-lip, 100
 Micrococcus, 167
 Middle cerebral artery, thrombosis of,
 481
 — *cf* disease of, 208
 Milium, 241
 Milky tubercles, acute, 273
 Milk, condensed, 30
 — composition of, 43
 — cow's, 25, 206
 — "modified," 296
 — Pasteurization of, 202
 — human, composition of, 45, 272
 — prepared, 45
 — tubercular infection from, 231
 Mismatch (toes), 250
 Mural vegetation, 273, 241
 Mixed noma, 223
 Mobile episcia, 217
 Moles, 247
 Mumps, *cf* 217 *cf sup.*
 Morbus coxi, 629
 Mortality after tracheotomy, 201

MOE

- Mortality in infancy, 15
 Mother's mark, 309
 Mouth, absence of, 169
 — defects of, affecting speech, 166, 177
 — deformities of, 195
 — diseases of, 59
 — examination of, 35
 Mucoid spot of throat, 69
 Mucous cyst of pharynx, 73
 — patches, 418
 Mumps, 322
 Muscular system, 683 *et seq.*
 Muscles, deficiencies of, 695
 Muscular atrophy, 328
 — spasm, 759
 Myelitis, 536
 Myelocle, 327 *et seq.*
 Myositis, 323
 Myositis ossificans, 693
 Myosoma, 343
 Myosipoma, 712
 Myosomatia, 324

- Nævus, 345
 — congenital, 349
 — of labia, 352
 — lipomatous, 356
 — lymphatic, 356
 — of rectum, 354, 357
 — of tongue, 355
 Nævuses, 719
 Nasal adenoid vegetation, 71
 Nasal cavity, 269
 — obstruction, 304
 Nasel, diseases of, 29
 Nasel-arches fetalis, 30
 Nervous of jaw, 68, 606
 — of palate, 607
 — post-typhoid, 52
 — of rib—angryoma, 596
 — of spinous process, 664, 675
 Nephritis, acute, 516
 — chronic, 516
 — in diphtheria, 269
 — — malarial fever, 344
 — — pneumonia, 230
 — — scarlet fever, 264
 — septic, 264
 — pyonephrosis, 459
 Nervous system, 7
 — — diseases of, 438
 Neuritis, 345
 Neuroma, 714
 Night cry, 643
 — starting, 643

OTT

- "Now-day six," 34
 Nævus orbis gen., 764
 Nodular, rheumatic, 362, 462
 Noma pudenda, 379
 Nose, diseases of, 705
 — dry catarrh of, 706
 — malformation of, 705
 Nystagmus, 909
 Ocular water, 45
 Obliteration of bile ducts, 173
 Obstetrical palsy, 24
 Obstruction of bowels, acute, 115, 132
 — — chronic, 135
 — — congenital, 120
 Obturator, 165
 Obturator foramen, 166
 Occipito-atlantoid disease, 664, 791
 — — fixation, 791
 Oedema of scrotum, 451
 — — semicircular, 35
 Oesophageal glands, hypertrophy of, 76
 — varix, 76
 Oesophagitis, 76
 Oesophagotomy, 76
 Oesophagus, structure of, 74
 — deformities of, 172
 — foreign bodies in, 71
 Odium abietis, 60
 Omphalitis, 31
 Ophthalmia, 746
 — maligna, 746
 Open division in club-foot, 166, 791
 Opiumism under anaesthetics, 765
 Ophthalmia gonorrhoeal, 76
 Optic atrophy, 414 *et seq.*
 — neuritis, 413, 418, 458
 Optic nerve, 354
 Orchitis, 354
 Osteitis, 413, 754
 Osteoma, 716
 Osteomalacia, infantile, 609
 — in rickets, 400
 Osteomyelitis, acute, 601 *et seq.*
 — — pyogenic, 602
 — chronic circumscripta, 604
 — — diffuse, 606
 — condensing, 606
 — pyemic, 609
 Osteophytic growths in rickets, 413
 Ostomy, 419, 381
 — for fæcal knot, 631
 — of ribs, 743
 Otitis, 559
 Otitis externa, 707

OTI

- Otitis media, 440, 446, 445 *et seq.* 467,
766
— in measles, 276
— scarlet fever, 263
— feverishness in, 273
Ovarian hernia, 580
— tumors, 585
Overshoot of incisor from periodontitis, 597
Overlying, 300
Oxyuris, 109
Oxera, 208

PACHYPTERMATOCYTES, 367

Packs in scarlet fever, 271

Pain, 761

Pallid arch, shape of, 165

— cleft of, 163

Papilloma, 347

— of bronchial fissures, 371

— of larynx, 308

— of tongue, 365

Papules, syphilitic, 489

Parameiosis in pericardial effusion, 345

Paralysis, acute atrophic, 539

— cerebral, 423

— after diphtheria, 290

— infantile, 539

— obstetrical, 24

— pseudo-hypertrophic, 348

Parelytic clonus, 492

— club-foot, 617

Paraphimosis, 337

Paraplegia, 534

— ataxic, 438

— spastic, 471

— in spine lesion, 438

— in spinal cord, 534, 550, 676, 798

Paratyphoid fever, 569

Parker's operation in club-foot, 615

Perforated abscess, 590

Perforins, 322

Petella, dislocation of, 259

— in knee joint, 416

— necrosis of, 507

Patent urachus, 30, 370

Pellagra rheumatica, 579

Pelvic abscess, 646

— deformity in rickets, 409, 414

Pemphigus, 341

— syphilitic, 470

Peso, abscess of, 575

Peri-auricular abscess, 674, 647

Pericarditis, 331

— acute, 331

— chronic, 335

PNE

Pneumonia, diagnosis of, 335

— symptoms of, 332

— in abscess, 490

— in nephritis, 266

— in rheumatism, 342

— in scarlet fever, 264

Periglomerular abscess, 352, 384

Periapical abscess, 554

Periosteophagial abscess, 75, 25

Peritonsillar abscess, 590

Peritonitis, 595

— albuminous, 607

— chronic, 598

— exanthematic, 590

— syphilitic, 599

Peritonsillar abscess, 545

Peritonsillar abscess, 595

Peritonsillar abscess, 121, 125

Peritonsillar abscess, 118

— effusion, chronic, 122

Peritonsillar abscess, 115

— suppurative, 117

— chronic, 121

— in scarlet fever, 123

— in scarlet fever, 305

— in nephritis, 267

— paracent, general, 118

— tubercular, abscess, 118

Peritonsillar abscess, 117, 125, 125

Peritonsillar abscess, 117, 118, 125

Peritonsillar abscess, 301

Pes canis, 676, 686, 688

— in gross vulgus, 415, 414

— pigs, 537, 700

— plagues, 569, 703

— proutis acipitatus, 619

"Pyti mal," 498

Pharyngeal tonsil, 72

Pharyngitis, 72

Pharynx, abscess of, 73

— mucous cyst of, 73

Phimosis, 375

Phlebitis, umbilical, 38

Phlegmonous peritonitis, 590

Phthisis, acute, 211

— chronic, 211

Pigeon-breast, 349

Pigmentary mole, 352

Piles, 154

Pinea, diseases of, 709

Pinner of Davis jacket, 672

Pituitary, 234

— in rheumatism, 331

Pituitary-pneumonia, 430

— in rheumatism, 331

Pituitary, abortive, 028

PNE

- Pneumonia, cerebral, 429
 — crouping, 229
 — erysipelas, 225
 — — pathology of, 231
 — gastric, 229
 — in nephritis, 207
 — relapsing, 223
 — secondary, 216
 — wandering, 229
 Polyp, nasal, 205
 Polypus recti, 155
 — umbilical, 29
 Polypus, 159
 Pons, tumours of, 465
 Porrocephalus, 455
 Poroplastic jackets, 674, 734
 Post-nasal state, 349
 Post-haemiplegic epilepsy, 499
 Post-natal atresia, 34
 Post-partum meningeal hæmorrhage, 472
 Post-pharyngeal abscess, 73
 Post's disease, 664, 791
 — — ganglions in, 532, 672, 675, 731
 Post-vertebral abscess, 33, 524
 Pressure sores in club-foot, 689
 Primary amputations, 399
 — operations, 759
 — immediate excision of hip, 599
 Proctus of rectum, 151
 — of urethra, 574
 Prostate, enlarged, 574
 Pseudo-diphtheria, 294
 Pseudo-hypertrophic paralytic, 545
 Pseudo-paralysis, hysterical, 454
 Psoas abscess, 665, 675
 Psoriasis, 124
 Psoriasis, 749
 Psychological phenomena of labour, 9
 Palsy disease of joints, 612 of eye
 Palsy at birth, 5
 Palsy paradoxum, 345
 Pepsitoxia, 761
 Peripart, 379
 — hæmorrhagicæ, 379
 — simplex, 369
 Peristaltic peritonitis, 118
 Peritonæa, 521 of eye, 609
 — microgallia in, 609
 — in peritonitis, 501 of eye, 596
 Peroneal joint disease, 600
 Pexilis, 552

RAC

- Rational cure of leucæ, 192
 Radium, utilization of, 793
 Radius, 166
 Radium therapy, 579
 Raynaud's disease, 347
 Reaction of degeneration, 521
 Reclining board, 425
 Recanal abscess in sacral disease, 696
 — bursa, 194
 — breast, 131
 — cervix, 125, 352
 — colon, 155
 — prostate, 151
 — uterine, 153
 — uterus, 155
 Rectangular talipes equinus, 531, 792
 Rectum, imperforate, 227
 Rectified knee, 699, 794
 Red composition at birth, 4
 "Redness of face" in rickets, 418
 Reflex vomiting, 70
 Reflex after excision of tonsils, 71
 Relapsed club-foot, 684, 689
 — neural, 597
 Removal of sequestra from spine, 575
 — of inflamed tonsils, 71
 Renal calculus, 157
 — new growth, 532
 Resection of bone in peritonitis, 532
 Resection, primary, 739
 Residual abscess, 657
 Respiration in newly born, 3
 — intra-uterine, 3
 Respiratory system, 153
 — system, diseases of, 152
 Retention of urine, 165, 169
 Reticular lymphangitis, 579
 Retro-oesophageal abscess, 73
 Retro-peritoneal glands, diseases of, 321
 Retro-pharyngeal abscess, 73
 Rheumatism, 598, 479
 Rheumatic arthritis, 620
 — nodules, 391
 Rhagidæ rhinorrhœa, 258
 Rhinorrhœa, 395
 — acute, 391
 — of adolescence, 414
 — in asthma, 395
 — bone changes in, 397
 — causes of, 395
 — congested, 399
 — deformities of, 397, 774
 — — treatment of, 397, 780
 — fatal, 400
 — from vulgus lepro, 416, 780
 — fatality in, 394

— "Quartæ streptococcus disease," 605

Quarant in pneumonia, 131

SPE

- Speech, anomalies of, 325
 Spina vera, 427
 — occulta, 327, 703
 Spinal abscess, 666, 674, 703
 — deformity, angular, 666
 — meningitis, 333
 — osteomyelitis, 327
 — rigidity, 669
 — sequestra, removal of, 675
 — spina, 672, 702
 — supports, 426, 674, 704, 707
 Spine, examination of, 422
 — lateral curvature of, 424, 425, 701
 — — causes of, 422, 701
 — rickets, 425, 700
 — scolio-lateral curvature of, 421, 701
 — weak, 421
 Spinous process, necrosis of, 664, 675
 Spines, enlargement of, 365
 — syphilitic affection of, 454
 Spina anemica, 354
 — enlargement in malaria, 354
 Spurious syphilis, 301
 Spurious talipes valgus, 689, 702
 Stammering, 518
 Staphylococcus, 164
 Status epilepticus, 500
 Steam bath, 100
 Steatoma, 95
 Stellate nerves, 329, 332
 Stenosis of the aorta, 330
 — of mitral valves, 330
 — of pulmonary artery, 329
 Stereotaxation, 49, 275, 701
 Sterno-clavicular joint, disease of, 698
 Sterno-mastoid, tumours of, 23, 691
 — trismus, 23, 691
 Stomatitis, 703
 Stomach, capacity of, in infancy, 5
 — of infancy, 5
 — constriction of, 108
 — dilatation of, 107
 — malformations of, 108
 — ulcer of, 105
 Stomatitis, 39
 — ulcervate, 62
 Stone in the bladder, 459
 Strangulated hernia, 149
 Stricture of œsophagus, 74
 — of rectum, 354
 — of urethra, 562, 574
 Struphalus, 57, 748
 Strumous dacryitis, 609
 — nodes, 583
 — paranasal nodes, 348
 Subcutaneous hernia, 399

T.E

- Subjective symptoms of spinal disease, 669
 Sublingual cysts, 117
 Subperiosteal abscess, 399
 Sulfamides, 741
 Sudden death in nephritis, 266
 Superciliary sinus, 109
 — ligula, 696
 — tricus, 333
 Suppuration of bronchial glands, 245
 Suprapubic lithotomy, 363
 Suprascapula, development of, 702
 Surgical scarlet fever, 762
 — treatment of erysipelas, 421
 — tuberculosis, 357
 Swallowing foreign bodies, 73
 Syndactylism, 698
 Syndesmosis, 165
 Synechia, acute tubercular, 622
 — catarrhal, 600
 — exanthematic, 620
 — iritis, 609
 — reparative, 619
 — syphilitic, 621
 — tubercular, 624
 Syphilis, 427
 — acquired, 427
 — arteria, 452
 — brain affection in, 436
 — congenital, 428
 — cruetaceous in, 435
 — eye affections in, 435
 — hepatitis in, 433
 — hereditary, 426
 — lung affections in, 433
 — malnutrition in, 430
 — post-natal, 427
 — skin affections in, 431
 — visceral lesions in, 433
 Syphilitic coryza, 489
 — auricular, 421
 — epiglottitis, 434, 600
 — hip-disease, 619, 650
 — iliac, 434
 — meningitis, 426, 423
 — osseous, 434 of hip
 — prosthitis, 431
 — pseudo-prosthetic, 434
 — spleen, 434
 — teeth, 435
 — scleritis, 434
 — testis, 435
 Syngo-myelocle, 428
 Tarsia meliocarditis, 110
 — sceler, 110

TAL

- Talipes, equinovarus, 687
 — calcaneus, 678, 680, 681, 686
 — equus, 680, 686
 — equino-varus, 678 *et seq.*, 707
 — paralytic, 687, 707
 — valgus, 680, 685, 686, 705
 — varus, 678 *et seq.*
 Tape-worm, 310
 Tarsometatarsal, 634
 — for club foot, 686
 Tarsus in infants, 9
 Teeth, eruption of, 30
 — epithelial, 435
 Telangiectasis, 548
 Temperature in health, 7
 — at birth, 7
 Tenosynovitis, 345
 Tenotomy for club foot, 685 *et seq.*, 702
 Test, nose, for laryngitis, 190
 Testis, theorchiditis of, 386
 — disease of, 354
 — inflammation of, 384
 — syphilitic, 387
 — tumor of, 384
 — tubercle of, 385
 — torsion, 387
 — undescended, 386
 Tetanus neonatorum, 34
 Tetany, 307
 Thigh, anatomy of, 758
 Thomas' splint, 418, 419, 425, 758, 761
 Thomson's disease, 542
 Thrombosis in infancy, 182
 Thread-worm, 309
 Thymus of cervical sinuses, 453
 Throat, 60
 Throat-caking, diphtheria from, 169
 Thyroid, 227
 Thyroid, diseases of, 705
 — duct cysts, 384, 390
 Thyro-glossal duct, 119, 120
 Thymus, 606, 607
 Tibia, development of, 412 *et seq.*
 Tonsils, disease of, 638
 Tongue, absence of, 167
 — anatomy of, 165
 — inflammation of, 165
 — worms of, 165, 355
 — papilloma of, 165
 — swelling, 167
 — tumor of, 165
 Tongue, 167
 Tonsil, vaccination of, 71
 — epithelial, 71
 — pharyngeal, 72
 Tonsils, removal of inflamed, 71

TUB

- Tubercular calculus, 34
 — hyperostosis, 69
 Tubercula, 678, 681
 — alveolar, 69
 Tubercles of testis, 384
 Tubercula, 25, 64, 704
 Trachea, stenosis of, 205, 208
 — aspirator, 200
 Tracheal dilation, 200
 — stricture, 174
 — stenosis, 204
 Trachionomy, 196, 218
 — tubes, 202
 Tracheo-bronchitis of infant, 74
 Translucent horn, 127
 Transpatellar eversion, 619
 Transposition of nose, 351
 Transverse myelitis, 356
 Traumatic stricture, 129
 Trephining skull, 466, 711
 — for epilepsy, 470
 — spine, 695
 Trepan, trepanotomy, 34
 Trephining, diseases of, 150
 Trochanter minor, 188
 Tumor, 180
 Tubercles of choroid, 174
 Tubercular abscess of kidney, 335
 — anastomosis, 334, 335
 — shoulder, 166, 257
 — wrist, 617, 757
 — adenitis, 379
 — cystitis, 366
 — dactylitis, 609
 — disease of ankle, 605
 — — of elbow, 646, 762
 — infection from milk, 137
 — meningitis, 440
 — — anatomy of, 441
 — — symptoms of, 442
 — — treatment of, 442
 — syphilitic, 612 *et seq.*
 — scrofula, 324
 — pyogenic, chronic, 129
 — testis, 384
 — abscess of bowel, 196
 Tuberculosis of adrenal, 109
 — acute milky, 775
 — congestive, 375
 — general, 375
 — — medical, 387, 784
 — — sub-acute, 375
 — of liver, 134
 — chronic, of lung, 248
 — diagnosis of, 216
 — primary infection, 784

TUB

- Tuberculous, symptoms of, 249
 — treatment of, 252
 — broncho-pneumonia, form of, 375
 — and scrofula, 377
 — typhoid form of, 373
 Tuberculous ulcers, 375
 Tubes for strichomy, 202
 Tumour growth, 713
 Tumours of laryngeal ganglia, 465
 — of bladder, 466
 — of brain, 466
 — of cerebellum, 462
 — cerebral, 462
 — — removal of, 464
 — congenital, 715 *et seq.*
 — of frontal lobe, 466
 — of kidneys, 552
 — of liver, 466
 — of ovary, 513
 — of penis, 464
 — of testis, 515
 Types of scrofula, 377
 Typho-pericarditis, 147, 148, 149
 Typhoid form of tuberculous, 373
 — fever, 298
 — venous, 460
 Typhus, 307
 — diagnosis of, 309
 — mortality in, 308
 — rash in, 309
 — symptoms of, 308
 — treatment of, 311

- Ulcérations of bone, tubercular, 359
 — of lip, 179
 — of navel, 37
 — of nose, 303
 — of trachea, 203, 208
 Ulcerative endocarditis, 326
 — monastic, 62
 Ulcers of the anus, 183
 — of the rectum, 183
 — tuberculous, 383
 — vulgar, 373, 379
 Unilateral arteritis, 34
 — fistula, 115
 — hemorrhage, 33
 — ischia, 147
 — phlebitis, 32
 — polypus, 31
 — ureti, 117
 Unilateral, deformities of, 148
 — diameter of, 39
 — ganglion of, 32
 — ulceration of, 30

UOVI

- Unintended testes, 481
 Union of epiphyses, dates of, 717
 Ununited fractures, 363, 384
 — — from syphilis, 367
 Urethra in scrofulous nephritis, 460
 Urthos, patient, 36, 37
 Urethral, 461
 — obstructions of, 374
 — prostatic of, 374
 Urethra, rupture of, 740
 — stricture of, 374
 Urinary vesicle, tumour of, 375
 — organs, diseases of, 350
 Urine, composition of, 6
 — emulsification of, 369
 — introduction of, 367
 — retention of, 369
 Uricaria, 356
 Urethra, enlargement of, 72
 — nerves of, 343
 — papillae of, 72
 VACCINATION, syphilis after, 371
 — crysipelas after, 365
 — glandular enlargement after, 365
 — performance of, 311
 — rash after, 315
 Vaccinosephitis, 371
 Vaginal discharge, due to worms, 309
 — hemorrhage, 31
 Vaginitis, 373, 375
 Vaginal bath, in asplasia, 372
 Variella, 310
 — contagiosa varum of, 310
 — diagnosis of, 313
 — eruption in, 312
 — gangrenous, 311
 — incubation of, 311
 — quarantine in, 311
 — treatment of, 313
 Varicose, 338
 Varicoid, 316
 — diagnosis of, 307
 — treatment of, 307
 Vaso, arterio-venous, 335, 383
 — lymphatic, 346, 348
 — of esophagus, 70
 Veal-tek, 377
 Venous aneurysm, 349
 Venous berria, 349
 Venous calcareous, 362
 Venous emphysema, 319
 Venous aneurysm, 352
 Vexal ceptery of lungs, 4
 Vomiting, alcoholic, 95

VOM

- Vomiting in cerebral tumor, 451
 — in chloroform anesthesia, 297
 — in giastic catarrh, 85
 — in hysteria, 511
 — in infants, 79
 — in meningitis, 442
 — in obstruction of the bowels, 107
 — in peritonitis, 164
 — in scarlet fever, 293
 — in whooping-cough, 319
 Vulvar area, 842
 — ulcers, 829
 Vulvitis, 525, 773

- WANTERING pneumonia, 209
 Warts of vulva, 579
 Water on the brain, 454
 Weak voice, 423
 Weaning, 47
 Web-fingers, 694
 — toes, 699
 Weight and height, 10
 — increase of, 9
 — table of, 10
 Wet nurse, 40
 Whey, 48

WYM

- "White lock-jaw," 55
 Whooping-cough, 317
 — broncho-pneumonia in, 329
 — contagiousness of, 312
 — convulsions in, 319
 — diagnosis of, 320
 — duration in, 319
 — emphysema in, 319
 — incubation of, 318
 — pathology of, 320
 — intercurrents after, 320
 — treatment of, 320
 Wickel's disease, 28
 Wild-catfever, 516
 Worms, intestinal, 709
 — round, 110
 — tape, 110
 — thread, 109
 Worm management, 269
 Wild joint, disease of, 617, 787
 Wryneck, 23, 147, 794

WYTH, 2

- Yeasty diarrhoea, 68
 — diarrhoea, 254

AN INTRODUCTION TO HUMAN PHYSIOLOGY.

By AUGUSTUS D. WALLER, M.D., Lecturer on Physiology at St. Mary's Hospital Medical School, London; late External Examiner at the Victoria University. With Bibliography, Index, and 304 Illustrations. SECOND EDITION. 8vo, 648 pages, \$1.00.

"The only justification for a new work of this kind would be an unusually high standard of excellence, and after a careful perusal of Dr. Waller's book we unhesitatingly pronounce that it meets this exact test. There is in fact no better book which can be recommended to students. . . . In conclusion we have only to wish the book the success it so thoroughly deserves, both as a text-book, for which it is admirably adapted, and as a collateral and instructive library book. The last pages on hygienic suggestion and the associated medical and general phenomena may be especially recommended for every reader."

—*British Medical Journal*.

"This book is remarkable for simplicity, accuracy, and style. It is an admirable introduction and collateral and continuous reading. The old and the student acquire new ground in their present gain. Diagrams, diagrams and diagrams abound, and are most for statements that denote wide research and thoughtful plan, and the work exemplifies the author's own special talent in the department of physiology. . . . To the physician who is well read, this 'Introduction to Human Physiology' is of great value."

—*Medical Record*, N. Y.

QUAIN'S ELEMENTS OF ANATOMY. The Tenth Edition.

Edited by EDWARD ALBERT SCHÄFER, F.R.S., Professor of Physiology and Histology in University College, London, and GEORGE DANCER THANE, Professor of Anatomy in University College, London. In three volumes (three parts). Illustrated by very numerous Engravings, many of which are colored. Each part with Index and Glossary. Royal 8vo.

- Vol. I. Part I. Embryology. By Professor SCHÄFER. \$5.00.
- " " II. General Anatomy of Histology. By Professor SCHÄFER. \$4.00.
- " II. " I. Osteology. By Professor THANE. \$5.00.
- " II. " II. Arthrology, Myology, Angiology. By Professor THANE. \$5.00.
- " III. " I. The Spinal Cord and Brain. By Professor SCHÄFER. \$4.00.
- " III. " II. The Nerves. By Professor THANE. \$5.00.
- " III. " III. Organs of the Senses. By Prof. SCHÄFER. \$4.00.
- " III. " IV. Splanchology. By Professor SCHÄFER and JOSEPH SHERBOURNE. \$4.50.

Appendix. Superficial and Topographical Anatomy. By Professor THANE and Professor RICHARD J. GUTHRIE. \$1.00.

MANUAL OF BACTERIOLOGY. For Practitioners and Students. With especial reference to Practical Methods.

By Dr. S. L. SCHENK, Professor (Extraordinary) in the University of Vienna. Translated from the German, with an Appendix, by W. R. DUNN, D.M.D. Univ. Ind.; late University Traveling Professor in Medicine. With 100 Illustrations, some of which are colored. 8vo, 124 pages, \$5.00.

DISEASES AND INJURIES OF THE TEETH, INCLUDING PATHOLOGY AND TREATMENT: A Manual of Practical Dentistry for Students and Practitioners.

By MORTON SMALE, M.R.C.S., L.S.A., L.D.S., Dental Surgeon to St. Mary's Hospital, Dean of the School, Dental Hospital of London; Member of Board of Examiners for Dental Surgery, Royal College of Surgeons of England; and J. F. COLYER, L.R.C.P., M.R.C.S., L.D.S., Assistant Dental Surgeon to Charing Cross Hospital, and Assistant Dental Surgeon to the Dental Hospital of London. With nearly 300 Illustrations. 8vo, 457 pages, \$4.00.

ESSENTIALS OF CHEMICAL PHYSIOLOGY.

By W. D. HALLIBURTON, M.D., F.R.S., Professor of Physiology, King's College, London. With 74 Illustrations. 8vo, 178 pages, \$1.50.

"This book means of instruction in the same way as Prof. Schäfer's 'Essentials' treatise of Histology. It contains a number of elementary and advanced exercises of lessons, followed by each time by a brief description of the facts related to the exercises which are intended to be performed by each student of the class."

Send, Longmans, Green, & Co., 111, 112 and 113, Catalogue of Medical Works to any address upon request.

LONGMANS, GREEN, & CO., PUBLISHERS.

Date Due

759

YALE
MEDICAL
LIBRARY

Demco 293-5

RJ45
897A

